

NATIONAL
BUILDING
CODE

1955

Golden Anniversary
EDITION

Recommended By

THE NATIONAL BOARD OF FIRE UNDERWRITERS

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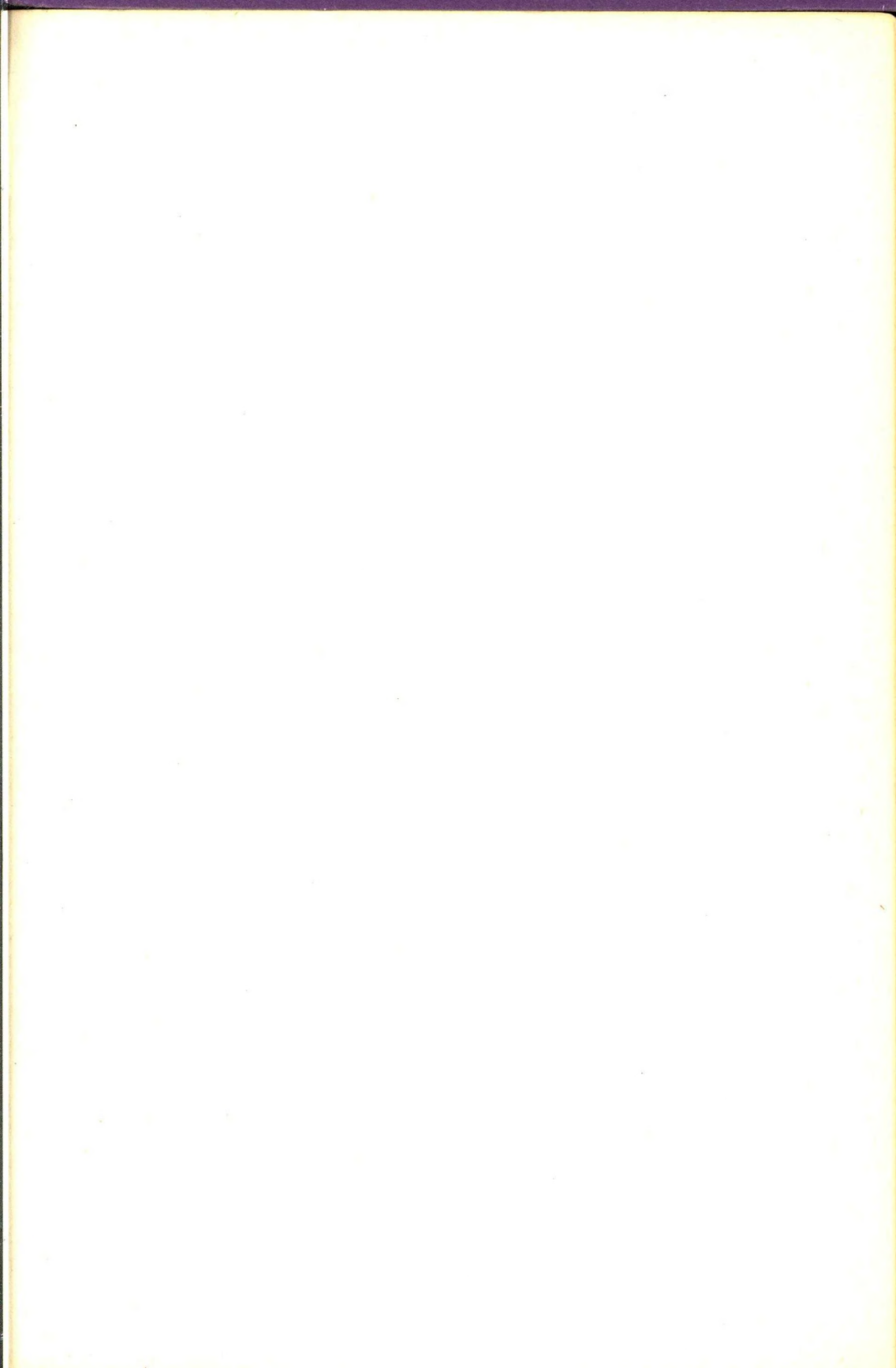
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BUILDING CODE

ARTICLE I.

ADMINISTRATION.

SECTION 100. TITLE, PURPOSE AND SCOPE.

100.1. Short title.

This ordinance shall be known and may be cited as "the Building Code", hereinafter referred to as "this code."

100.2. Purpose of code.

The purpose of this code is to provide for safety, health and public welfare through structural strength and stability, means of egress, adequate light and ventilation and protection to life and property from fire and hazards incident to the design, construction, alteration, removal or demolition of buildings and structures.

100.3. Scope of code.

The provisions of this code apply to the construction, alteration, equipment, use and occupancy, location and maintenance of buildings and structures and to appurtenances such as vaults, areaways and street encroachments, hereafter erected and, where expressly stated, existing on land or over water and to buildings and structures and equipment for the operation thereof hereafter moved or demolished in the municipality. The provisions of this code based on occupancy also apply to conversions of existing buildings and structures or portions thereof from one occupancy classification to another.

100.4. Validity of other laws.

Nothing in this code shall be construed to prevent the enforcement of other laws which prescribe more restrictive limitations.

100.5. Raising and lowering of buildings or structures.

Nothing in this code shall prohibit the raising or lowering of a building or structure to meet a change of grade in the street on which it is located, provided the building or structure is not otherwise altered.

100.6. Maintenance and use.

It shall be unlawful to maintain, occupy or use a building or structure, or part thereof, that has been erected or altered in violation of the provisions of this code, and no building or structure shall be occupied unless it is in a safe and habitable condition as prescribed in this code.

100.7. Materials and methods of construction.

Nothing in this code shall be construed to prevent the use of any material or method of construction whether or not specifically provided for in this code if, upon presentation of plans, methods of analysis, test data or other necessary information, to the building official by the interested person or persons, the building official is satisfied that the proposed material or method of construction complies with specific provisions of or conforms to the intent of this code.

SECTION 101. TESTS AND APPROVALS.**101.1. Quality of materials and method of construction.**

Any material or method of construction failing to conform to the requirements of this code shall not be used. Whenever there is reason to doubt the quality of a material or method of construction to be used in a building or structure the building official may require tests to be made to establish its suitability or to determine whether it conforms to the intent of this code. Such tests shall be made at the expense of the owner or his agent.

101.2. Test methods.

Test methods shall be in accordance with those specified in this code for the material or method of construction in question. Where no appropriate test method is prescribed in this code the test procedure shall be determined by the building official.

101.3 Conduct of tests.

Tests shall be conducted under the supervision of the building official except that duly authenticated tests or certification by a competent person or laboratory may be accepted by him in lieu of tests under his own supervision.

101.4. Approvals.

Any material or method of construction meeting the requirements of this code shall be approved by the building official within a reasonable time after the completion of the tests. All such approvals and the conditions under which they are issued shall be reported and kept on file, open to public inspection.

101.5. Conditions attached to approvals.

(a) Materials or methods of construction which have been tested and approved shall be used and installed in accordance with the terms of approval.

(b) So far as practicable materials for which special approvals have been issued shall have a distinctive brand mark or label for identification impressed on or otherwise attached to them so that the material for which special approval was obtained may be readily identified.

101.6. Additional tests.

The building official may require tests to be repeated, if at any time there is reason to believe that a material no longer conforms to the requirements on which its approval was based.

SECTION 102. PERMITS.

102.1. Permit required.

It shall be unlawful to construct, alter, remove or demolish, or to commence the construction, alteration, removal or demolition of a building or structure or install equipment for the operation of a building or structure without first filing with the building official an application in writing and obtaining a formal permit.

102.2. Completion of work heretofore authorized.

Nothing in this code shall require changes in the plans, construction or designated use of a building or structure or portion thereof for which a lawful permit has been heretofore issued or which has been otherwise lawfully authorized, and the construction of which shall have been actually begun within 90 days after this code becomes effective and which entire building or structure shall be completed, as authorized, within two years thereafter.

102.3. Application form.

An application for a permit shall be submitted in such form as the building official may prescribe. Such application shall contain the full names and addresses of the applicant and of the owner, and, if the owner is a corporate body, of its responsible officer. The application shall also describe briefly the proposed work and shall give such additional information as may be required by the building official for an intelligent understanding of the work proposed.

102.4. Those authorized to make application.

Applications shall be made by the owner or lessee, or agent of either, or the architect, engineer or builder employed in connection with the proposed work. If such application is made by a person other than the owner in fee, it shall be accompanied by a duly verified affidavit of the owner in fee or the person making the application that the proposed work is authorized by the owner in fee and that the person making the application is authorized to make such application.

102.5. Amendments to application.

Nothing in this code shall prohibit the filing of amendments to an application or to a plan or other record accompanying same, at any time before the completion of the work for which the permit was issued. Such amendments shall be filed with and be deemed a part of the original application, if approved before the certificate of occupancy has been issued otherwise a new application for the alteration shall be made and a permit secured.

102.6. Plans to accompany application.

Applications for permits shall be accompanied by drawings of the proposed work, drawn to scale, showing when necessary, floor plans, sections, elevations, structural details, computations and stress diagrams, as the building official may require.

102.7. Plot plan.

When required by the building official, there shall be submitted a plot plan in a form and size designated by the building official for filing permanently with the permit record, drawn to scale, with all dimensions figured, showing accurately the size and exact location of all proposed new construction and the relation to other existing or proposed buildings or structures on the same lot and other buildings or structures on adjoining property within 15 feet of the property lines. In the case of demolition, the plot plan shall show the buildings or structures to be demolished and the buildings or structures on the same lot that are to remain.

102.8. Repairs.

Repairs may be made without filing an application or obtaining a permit.

102.9. Action on application.

The building official shall examine applications for permits, within a reasonable time after filing. If, after examination, he finds no objections to the same and it appears that the proposed work will be in compliance with the laws and ordinances applicable thereto and the proposed construction or work will be safe, he shall approve such application and issue a permit for the proposed work as soon as practicable. If his examination reveals otherwise, he shall reject such application, note his findings in a written report to be attached to the application and deliver a copy to the applicant.

102.10. Revocation of permit.

The building official may revoke a permit or approval issued in case there has been any false statement or misrepresentation as to a material fact in the application or plans on which the permit or approval was based.

102.11. Approval of permit in part.

Nothing in this code shall be construed to prevent the building official from issuing a permit for the construction of part of a building or structure before the entire plans and detailed statements of said building or structure have been submitted or approved, provided adequate information and detailed statements have been submitted for the same and have been found to comply with this code.

102.12. Permit for removal.

No permit to remove a building or structure shall be issued until notice of application thereof shall have been given to the owners of property adjoining the property upon which said building or structure is to be moved and to the owners of wires or other impediments the temporary removal of which will be necessary, and an opportunity has been given said owners to be heard upon such application; nor until a bond in an adequate sum has been filed with the officer of proper authority, to indemnify and save harmless the municipality from damage.

102.13. Compliance with permit.

All work performed under a permit issued by the building official shall conform to the approved application and plans, and approved amendments thereto. The location of all new construction as shown on the approval plot plan or an approved amendment thereto, shall be strictly adhered to.

102.14. Reducing or diminishing lot area.

It shall be unlawful to reduce or diminish the area of a lot or plot of which a plot plan has been filed and has been used as the basis for a permit, unless a revised plot plan showing the proposed changes in conditions shall have been filed and approved; provided that this shall not apply when the lot is reduced by reason of a street opening or widening or other public improvement.

102.15. Signature to permit.

Every permit issued by the building official under the provisions of this code shall have his signature affixed thereto; but this shall not prevent him from authorizing a subordinate to affix the building official's signature.

102.16. Expiration of permit.

A permit under which no work is commenced within 6 months after issuance shall expire by limitation and a new permit shall be secured before work is started.

102.17. Posting of permit.

A copy of the permit shall be kept on the premises for public inspection during the prosecution of the work and until the com-

pletion of the same. The building official may require a certified copy of the approved plans to be kept on the premises at all times from the commencement of the work to the completion thereof.

102.18. Commencement notice to be given.

The building official shall be given at least 24 hours' notice of the starting of work under a permit.

SECTION 103. CERTIFICATES.

103.1. Certificate of occupancy.

No building or structure shall be occupied or used, in whole or in part, until a certificate of occupancy shall have been issued by the building official and posted on the premises stating the purpose for which the building may be used in its several parts, the maximum permissible live loads on the several floors, the number of occupants that may be accommodated in the several stories, in case such number is limited by a provision of law or by the permit, and all special stipulations of the permit, if any.

103.2. Temporary certificate of occupancy.

Upon request of the holder of a permit, or of the owner, the building official may issue a temporary certificate of occupancy for part of a building or structure; provided that such temporary occupancy or use would not jeopardize life or property.

103.3. Certificate of occupancy for altered buildings or structures.

No building or structure enlarged or extended, or so altered, wholly or in part, as to change its classification of occupancy, and no altered building or structure for which a certificate of occupancy has not been heretofore issued, shall be occupied or used, in whole or in part, until a certificate of occupancy shall have been issued by the building official; provided that if the occupancy or use of such building was not discontinued during the work or alteration, the occupancy or use of the building or structure shall not continue for more than 30 days after completion of the alterations unless such certificate shall have been issued.

103.4. Certificate for change of occupancy.

(a) No change of occupancy shall be made in a building or structure that is not consistent with the last issued certificate of occupancy for such building or structure, unless a new certificate of occupancy is secured.

(b) The occupancy of a building or structure shall not be deemed to have changed because of a temporary vacancy or change of ownership or tenancy. The re-establishment in a building or

structure, after a change of occupancy has been made, of a prior use that is not permitted in a new building or structure of the same type of construction, is prohibited. The change from a specifically prohibited use to another specifically prohibited use shall not be made.

103.5. Issuance of certificate of occupancy.

A certificate of occupancy shall be issued within 5 days after written application therefor, if the building or structure at the time of such application shall be entitled thereto. Copies of certificates of occupancy shall be furnished, on request, to persons having a proprietary interest in the building or structure.

103.6. Certificate for completed installations.

When a certificate is specifically required by a provision of this code for an installation, extension or alteration of equipment or appliances, it shall be unlawful to use or permit the use of such equipment or appliances to which such provision applies, until the appropriate certificate has been issued.

SECTION 104. UNSAFE BUILDINGS AND STRUCTURES.

104.1. Removal or made safe.

When a building or structure or any portion thereof is found unsafe upon inspection by the building official, he shall order such building or structure or any portion thereof to be made safe or taken down and removed. The term unsafe building or structure or portion thereof shall include buildings or structures or portions thereof structurally unsafe; unstable; unsanitary; inadequately provided with exit facilities; constituting a fire hazard; unsuitable or improper for the use or occupancy to which they are put; constituting a hazard to health or safety because of inadequate maintenance, dilapidation, obsolescence or abandonment; or otherwise dangerous to life or property.

104.2. Restoration of unsafe building or structure.

A building or structure or part thereof declared unsafe by the building official may be restored to safe condition; provided that if the damage or cost of reconstruction or restoration is in excess of 50 per cent of the value of the building or structure, exclusive of foundations, such buildings or structures, if reconstructed or restored, shall be made to conform with respect to materials and type of construction, to the requirements of this code; but no change of use or occupancy shall be compelled by reason of such reconstruction or restoration.

104.3. Notice of unsafe buildings or structures.

Upon determining that a building or structure or portion thereof is unsafe, the building official shall serve or cause to be served on the owner, or some one of the owners, executors, administrators, agents, lessees or other persons who may have a vested or contingent interest in the same, a written notice containing a description of the building or structure or portion thereof deemed unsafe, a statement of the particulars in which the building or structure or portion thereof is unsafe, and an order requiring the same to be made safe and secure or removed, as may be deemed necessary by him. If the person to whom such notice and order is addressed cannot be found after diligent search, then such notice and order shall be sent by registered mail to the last known address of such person; and a copy of such notice shall be posted in a conspicuous place on the premises to which it relates. Such mailing and posting shall be deemed adequate service.

104.4. Disregard of unsafe notice.

If the person served with a notice or order to remove or repair an unsafe building or structure or portion thereof should fail, within a reasonable time, to comply with the requirements thereof, the building official shall advise the corporation counsel of all the facts in the case, and shall institute an appropriate action in the courts to compel a compliance.

104.5. Emergency work.

In case there shall be, in the opinion of the building official, actual and immediate danger of failure or collapse of a building or structure or portion thereof so as to endanger life or property, the building official shall obtain the necessary funds from the city treasury, purchase such material and employ such labor and cause the necessary work to be done to render said building or structure or portion thereof, temporarily safe, whether the procedure prescribed in this section has been instituted or not.

104.6. Vacating unsafe buildings or structures and closing streets.

When a building or structure or portion thereof is in an unsafe condition so that life is endangered thereby, the building official shall order and require the inmates and occupants to vacate the same forthwith. He shall, when necessary for the public safety, temporarily close sidewalks, streets, buildings, structures and places adjacent to such building or structure, and prohibit the same from being used.

104.7. Recovery of costs.

The corporation counsel shall institute proper actions against the owner of premises for the recovery of costs incurred by the building official in the performance of emergency work.

SECTION 105. VIOLATIONS.**105.1. Notices of violations.**

Whenever the building official is satisfied that a building or structure, or any work in connection therewith, the erection, construction or alteration, execution of which is regulated, permitted or forbidden by this code, is being erected, constructed, or altered, in violation of the provisions or requirements of this code, or in violation of a detailed statement or plan submitted and approved thereunder, or of a permit or certificate issued thereunder, he shall serve a written notice or order upon the person responsible therefore directing discontinuance of such illegal action and the remedying of the condition that is in violation of the provisions or requirements of this code.

105.2. Disregard of violation notices.

In case a violation notice or order is not properly complied with, the building official shall notify the corporation counsel of such noncompliance, and the corporation counsel upon such notice shall institute an appropriate action or proceeding at law or in equity, to restrain, correct or remove such violation, or the execution of work thereon, or to restrain or correct the erection or alteration of, or to require the removal of, or to prevent the occupancy or use of, the building or structure erected, constructed or altered, in violation of, or not in compliance with, the provisions of this code or with respect to which the requirements thereof, or of any order or direction made pursuant to provisions contained therein, shall not have been complied with.

105.3. Stopping work.

Whenever in the opinion of the building official, by reason of defective or illegal work in violation of a provision or requirement of this code, the continuance of a building operation is contrary to public welfare, he shall order, in writing, all further work to be stopped and may require suspension of all work until the condition in violation has been corrected.

SECTION 106. PENALTIES.**106.1. Noncompliance.**

A person who shall violate a provision of this code or fails to comply therewith or with any of the requirements thereof, or who shall erect, construct, alter or repair, or has erected, constructed, altered or repaired a building or structure or portion thereof, in violation of a detailed statement or plan submitted and approved thereunder, or of a permit or certificate issued thereunder, shall be guilty of a misdemeanor punishable by a fine of not less than \$10 nor more than \$100, or by imprisonment not exceeding 6 months, or by both such fine and imprisonment. Also

the owner of a building or structure or portion thereof, or of the premises where anything in violation of this code shall be placed or shall exist, and an architect, engineer, builder, contractor, agent, person or corporation employed in connection therewith and who may have assisted in the commission of such violation shall each be guilty of a separate offense and upon conviction thereof shall be punishable by a fine of not less than \$10 nor more than \$100, or by imprisonment not exceeding 6 months, or by both such fine and imprisonment.

106.2. Abatement.

The imposition of the penalties herein prescribed shall not preclude the corporation counsel from instituting an appropriate action or proceeding to prevent an unlawful erection, construction, reconstruction, alteration, repair, conversion, maintenance or use, or to restrain, correct or abate a violation, or to prevent the occupancy of a building or structure or portion thereof, or of the premises, or to prevent an illegal act, conduct, business or use in or about any premises.

SECTION 107. BOARD OF APPEAL.

107.1. Appointment.

There is hereby established in the municipality a board to be called the Board of Appeal, consisting of 5 members who are qualified by experience and training to pass upon matters pertaining to building construction and who shall be appointed by the chief appointing authority. The chief appointing authority shall designate one of the members to serve as chairman.

107.2. Term of office.

The chief appointing authority of the municipality shall appoint one member of the Board of Appeal for a term of one year, one member for a term of 2 years, one member for a term of 3 years, one member for a term of 4 years, and one member for a term of 5 years. Upon expiration of the term of office of a member of the board, his successor shall be appointed for a term of 5 years. Vacancies shall be filled for an unexpired term in the manner in which original appointments are required to be made. Continued absence of any member from regular meetings of the board shall, at the discretion of the chief appointing authority of the municipality, render any such member liable to immediate removal from office by such chief appointing officer.

107.3. Quorum.

Four members of the board shall constitute a quorum. In varying the application of any provision of this code or in modifying an order of the building official, affirmative votes of 3 members shall be required. No member of the board shall pass upon

any question in which he, or any corporation in which he is a shareholder, is interested.

107.4. Meetings and records.

Meetings of the board shall be held at the call of the chairman and at such other times as the board may determine. All hearings before the board shall be open to the public. The board shall keep minutes of its proceedings, showing the vote of each member upon every question, or if absent or failing to vote, indicating such facts, and shall also keep records of its examinations and other official action. Such minutes and such records shall be public records.

107.5. Procedure.

The board shall establish rules and regulations for its own procedure not inconsistent with the provisions of this code.

107.6. Appeals.

(a) Any person aggrieved or the head of any agency of the municipality may take an appeal to the Board of Appeal from any decision of the building official.

(b) An appeal may be taken within 30 days from the date of the decision appealed, by filing with the building official and with the Board of Appeal a notice of appeal, specifying the grounds thereof, except that in the case of a building or structure which in the opinion of the building official, is unsafe or dangerous, the building official may in his order limit the time for such appeal to a shorter period. The building official shall forthwith transmit to the Board of Appeal all the papers upon which the action appealed from was taken.

107.7. Modifications and variations by the Board of Appeal.

(a) The Board of Appeal, when so appealed to and after a public hearing, may vary the application of any provision of this code to any particular case when, in its opinion, the enforcement thereof would do manifest injustice, and would be contrary to the spirit and purpose of this code or public interest, or when, in its opinion, the interpretation of the building official should be modified or reversed.

(b) A decision of the Board of Appeal to vary the application of any provision of this code, or to modify an order of the building official, shall specify in what manner such variation or modification is made, the conditions upon which it is made, and the reasons therefore.

107.8. Decisions of the Board of Appeal.

(a) The Board of Appeal shall in every case reach a decision without unreasonable or unnecessary delay. Every decision of the Board of Appeal shall be in writing and shall indicate the vote

upon the decision. Every decision shall be promptly filed in the office of the building official and shall be open to public inspection. A certified copy shall be sent by mail or otherwise to the appellant and a copy shall be kept publicly posted in the office of the building official for 2 weeks after filing.

(b) If a decision of the Board of Appeal reverses or modifies a refusal, order, or disallowance of the building official, or varies the application of any provision of this code, the building official shall take action immediately in accordance with such decision.

107.9. Appeals from decisions of the Board of Appeal.

A person aggrieved by a decision of said board, whether previously a party to the proceeding or not, or an officer or board, may, within 15 days after the filing of such decision in the office of the building official, apply to the appropriate court to correct errors of law in such decisions.

ARTICLE II.

DEFINITIONS.

SECTION 200. DEFINITIONS.

(a) Unless otherwise expressly stated, the following terms shall, for the purpose of this code, have the meanings indicated in this section.

(b) Words used in the present tense include the future; the singular number includes the plural and the plural the singular.

(c) Where terms are not defined in this section, they shall have their ordinarily accepted meanings or such as the context may imply.

Alley means any public thoroughfare less than 21 feet in width which has been legally dedicated or devoted to public use.

Alteration, as applied to a building or structure, means a change or rearrangement in the structural parts or in the exit facilities; or an enlargement, whether by extending on a side or by increasing in height; including work, other than repairs, that would affect safety or a vital element of an elevator, plumbing, gas piping, wiring, ventilating or heating installation; the term "alter" in its various moods and tenses and its participial forms, refers to the making of an alteration.

Amusement device means a mechanically operated device which is used to convey persons in an unusual manner as a form of entertainment.

Apartment—see "Dwelling unit."

Approved, as applied to a material, device or mode of construction, means approved by the building official in accordance with the provisions of this code, or by other authority designated by law to give approval in the matter in question.

ASTM means American Society for Testing Materials.

Assembly occupancy—see section 300.1.

Attic means the space between the ceiling beams of the top habitable story and the roof rafters.

Areaway means an uncovered subsurface space adjacent to a building.

Area means the maximum horizontal projected area of the building or structure at or above grade.

Automatic, as applied to a fire door or other opening protective, means normally held in an open position and automatically

closed by a releasing device that is actuated by abnormal high temperature or by a predetermined rate of rise in temperature.

Basement means a story of a building or structure having one-half or more of its clear height below grade. Also see "Story".

Basement parking garage—see "Garage".

Brick means a solid masonry unit having a shape approximately a rectangular prism, usually not larger than 12 by 4 by 4 inches. A brick may be made of burned clay or shale, of fire clay or mixtures thereof, of lime and sand, of cement and suitable aggregates, or of other approved materials.

Building means a combination of materials to form a construction that is safe and stable, and adapted to permanent or continuous occupancy for assembly, business, educational, high hazard, industrial, institutional, mercantile, residential or storage purposes; the term "building" shall be construed as if followed by the words "or portion thereof". For the purposes of this code, each portion of a building separated from other portions by a fire wall shall be considered as a separate building.

Building line means the line, established by law, beyond which a building shall not extend, except as specifically provided by law.

Building official means the officer or other designated authority charged with the administration and enforcement of this code, or his duly authorized representative.

Business occupancy—see section 300 !

Concrete means a mixture of portland cement, aggregates and water;

reinforced concrete means concrete in which reinforcement other than that provided for shrinkage or temperature changes is embedded in such a manner that the two materials act together in resisting forces.

Court means an open, uncovered, unoccupied space on the same lot with a building;

inner court means any court other than an outer court or a yard;

outer court means a court other than a yard having at least one side thereof opening on to a street, alley or yard or other permanent open space;

yard means a court on the same lot with a building extending along the entire length of a lot line.

Curb level means the elevation of the street curb as established in accordance with law;

referring to an excavation, it means the elevation at that point of the street curb which is nearest to the point of the excavation under consideration.

Dead load—see “Load, dead.”

Display sign means a structure that is arranged, intended, designed or used as an advertisement, announcement or direction; and includes a sign, sign screen, billboard and advertising devices of every kind.

Dwelling means a building occupied exclusively for residence purposes and having not more than two dwelling units or as a boarding or rooming house serving not more than 15 persons with meals or sleeping accommodations or both.

Dwelling unit means one or more rooms arranged for the use of one or more individuals living together as a single housekeeping unit, with cooking, living, sanitary and sleeping facilities.

Educational occupancy—see section 300.1.

Elevator means a hoisting and lowering mechanism equipped with a car or platform which moves in guides in a substantially vertical direction, and which serves two or more floors of a building or structure.

freight elevator means an elevator primarily used for carrying freight and on which only the operator and the persons necessary for unloading and loading the freight are permitted to ride.

passenger elevator means an elevator used primarily to carry persons other than the operator.

Enclosed parking garage—see “Garage”.

Existing means in existence before the time that this code becomes effective.

Exit doorway—see section 601.1.

Exit way—see section 601.1.

Fire door means a door and its assembly, so constructed and assembled in place as to give protection against the passage of fire.

Fire resistance rating means the time in hours that the material or construction will withstand the standard fire exposure as determined by a fire test made in conformity with the “Standard Methods of Fire Tests of Building Construction and Materials,” ASTM E119.

Fire-resistive construction includes fire-resistive construction—type A and fire-resistive construction—type B.

Fire retardant ceiling means a ceiling used in a floor and ceiling construction that has a fire resistance rating of one hour or more.

Fire walls—see “Walls”.

Fire window means a window and its assembly, so constructed and assembled in place as to give protection against exposure fires.

Freight elevator—see “Elevator”.

Garage means a building or structure or a portion thereof, in which a motor vehicle containing a flammable fluid in its fuel storage tank, is stored, housed, kept, repaired or serviced;

basement parking garage means an enclosed parking garage located in a basement, and includes an underground parking garage;

enclosed parking garage means a garage having exterior enclosure walls and used for the parking of motor vehicles;

motor vehicle service garage means a garage in which a flammable fluid for retail supply to motor vehicles is stored, housed or sold;

open air parking garage means a garage having not less than 50 per cent of two sides of the garage open to the air at each story and used for the parking of motor vehicles;

repair garage means a garage wherein major repairs may be made to more than two motor vehicles at a time.

Grade, with reference to a building or structure, means the average elevation of the ground adjoining the building or structure on all sides.

Habitable room means a room or enclosed floor space arranged for living, eating or sleeping purposes, not including bath or toilet rooms, laundries, pantries, foyers or communicating corridors.

Height, as applied to a building, means the vertical distance from grade to the average elevation of the roof of the highest story; “height” of a building in stories does not include basements—see “Story”;

height, as applied to a court, means the vertical distance from the level of the floor of the lowest story served by that court to the level under consideration;

height, as applied to a story, means the vertical distance from top to top of two successive tiers of floor beams or finished floor surfaces;

height, as applied to a wall, means the vertical distance to the top measured from the foundation wall, or from a girder or other immediate support of such wall.

High hazard occupancy—see section 300.1.

Hollow masonry unit—see “Masonry.”

Horizontal separation means a permanent open space between the building wall under consideration and the nearest line to

which a building is or may be legally built. One-half of the street width shall be used in determining the distance of horizontal separation for walls facing on a street and one-half of the narrowest space between two buildings on the same lot shall be used in determining the distance of horizontal separation between walls of buildings on the same lot.

Industrial occupancy—see section 300.1.

Institutional occupancy—see section 300.1.

Load, dead means the weight of all permanent construction including walls, floors, roofs, partitions, stairways and of fixed service equipment.

Load, live means the weight superimposed by the use and occupancy of the building or structure, not including the wind load, earthquake load or dead load.

Lot means a portion or parcel of land considered as a unit.

Lot line means a line dividing one lot from another, or from a street or other public space.

Masonry means a built-up construction or combination of building units of such materials as clay, shale, concrete, glass, gypsum or stone set in mortar; or plain concrete;

hollow masonry unit means a masonry unit whose net cross-sectional area in any plane parallel to the bearing surface is less than 75 per cent of its gross cross-sectional area measured in the same plane;

masonry of hollow units means masonry consisting wholly or in part of hollow masonry units laid contiguously in mortar;

solid masonry means masonry consisting of solid masonry units laid contiguously in mortar, or consisting of plain concrete;

solid masonry unit means a masonry unit whose net cross-sectional area in every plane parallel to the bearing surface is 75 per cent or more of its gross cross-sectional area measured in the same plane.

Mercantile occupancy—see section 300.1.

Motor vehicle service garage—see 'Garage'.

Multifamily house means a building or portion thereof containing three or more dwelling units; including tenement house, apartment house, flat.

Noncombustible as applied to a building construction material means a material which, in the form in which it is used, falls in one of the following groups (a) through (c). It does not apply to surface finish materials nor to the determination of whether a material is noncombustible from the standpoint of clearances to

heating appliances, flues or other sources of high temperature. No material shall be classed as noncombustible which is subject to increase in combustibility or flame spread rating beyond the limits herein established, through the effects of age, moisture or other atmospheric condition. Flame spread rating as used herein refers to ratings obtained according to the Standard Test Method for Fire Hazard Classification of Building Materials of Underwriters' Laboratories, Inc., ASTM E84.

(a) Materials no part of which will ignite and burn when subjected to fire. Any material which liberates flammable gas when heated to a temperature of 1,380 F., for five minutes shall not be considered noncombustible within the meaning of this paragraph.

(b) Materials having a structural base of noncombustible material, as defined in (a), with a surfacing not over $\frac{1}{8}$ -inch thick which has a flame spread rating not higher than 50.

(c) Materials, other than as described in (a) or (b), having a surface flame spread rating not higher than 25 without evidence of continued progressive combustion and of such composition that surfaces that would be exposed by cutting through the material in any way would not have a flame spread rating higher than 25 without evidence of continued progressive combustion.

Noncombustible construction includes protected noncombustible construction and unprotected noncombustible construction.

Occupied, as applied to a building, shall be construed as though followed by the words "or intended, arranged or designed to be occupied."

Open air parking garage—see "Garage".

Owner includes his duly authorized agent or attorney, a purchaser, devisee, fiduciary, and a person having a vested or contingent interest in the property in question.

Passenger elevator—see "Elevator."

Pent house means an enclosed structure other than a roof structure, located on the roof, extending not more than twelve feet above a roof and used primarily for living or recreational accommodations. Also see "Story."

Person includes corporation and copartnership as well as individual.

Place of assembly means a room or space used for assembly or educational occupancy for 100 or more occupants.

Plastic means a material that contains as an essential ingredient an organic substance of large molecular weight, is solid in its finished state, and, at some stage in its manufacture or in its processing into finished articles, can be shaped by flow.

Prefabricated means fabricated prior to erection or installation on a building or structure foundation.

Repair means the replacement of existing work with equivalent materials for the purpose of its maintenance; but not including additional work that would affect safety, or affect required exit facilities, or a vital element of an elevator, plumbing, gas piping, wiring, ventilating or heating installation.

Repair garage—see “Garage.”

Required means required by some provision of this code.

Residential occupancy—see section 300.1.

Roof structure means a structure above the roof of any part of a building enclosing a stairway, tank, elevator machinery or service equipment, or such part of a shaft as extends above the roof; and not housing living or recreational accommodations.

Self-closing, as applied to a fire door or other opening protective, means normally closed and equipped with an approved device which will insure closing after having been opened for use.

Separation, horizontal—see “Horizontal separation.”

Shaft means a vertical opening or passage through two or more floors of a building or through floors and roof.

Solid masonry—see “Masonry.”

Solid masonry unit—see “Masonry.”

Sprinklered means equipped with an approved automatic sprinkler system.

Stairway means one or more flights of stairs and the necessary landings and platforms connecting them, to form a continuous and uninterrupted passage from one story to another in a building or structure.

Storage occupancy—see section 300.1.

Story means that part of a building comprised between a floor and the floor or roof next above. A mezzanine shall be considered a story if it exceeds $33\frac{1}{3}$ per cent of the area of the floor immediately below. A pent house shall be considered a story if it exceeds 1,000 square feet or $33\frac{1}{3}$ per cent of the roof area. The basement of a building used for educational occupancy shall be considered a story if it is used for purposes other than storage or heating.

Street means a thoroughfare 21 feet or more in width which has been legally dedicated or devoted to public use.

Street line means a lot line dividing a lot from a street.

Structure means a combination of materials to form a construction that is safe and stable; including among others, buildings, stadiums, tents, reviewing stands, platforms, stagings, observation towers, radio towers, water tanks and towers, trestles, piers, wharves, sheds, coal bins, shelters, fences and display signs; the term structure shall be construed as if followed by the words "or part thereof."

Walls:

bearing wall means a wall which supports any vertical load in addition to its own weight;

cavity wall means a wall built of masonry units or of plain concrete, or a combination of these materials, so arranged as to provide an air space within the wall, and in which the inner and other wythes of the wall are tied together with metal ties;

faced wall means a wall in which the masonry facing and the backing are of different materials and are so bonded as to exert a common reaction under load;

fire wall means a wall constructed in accordance with section 800, for the purpose of subdividing buildings to restrict the spread of fire;

foundation wall means a wall below the floor nearest grade serving as a support for a wall, pier, column or other structural part of a building or structure;

masonry bonded hollow wall means a wall built of masonry units so arranged as to provide an air space within the wall, and in which the inner and outer wythes of the wall are tied together with masonry units;

non-bearing wall means a wall which supports no vertical load other than its own weight;

panel wall means a non-bearing wall built between columns or piers and wholly supported at each story;

veneered wall means a wall having a facing of masonry or other material securely attached to the backing, but not bonded so as to exert a common reaction under load.

Writing means and includes handwriting, typewriting, printing, photo-offset or any other form of reproduction in legible symbols or characters.

Written notice means a notification in writing delivered in person to the individual or to the parties intended or delivered at or sent by registered mail to the last business address known to the party giving the notice.

ARTICLE III.

CLASSIFICATION OF OCCUPANCIES AND SPECIAL
OCCUPANCY REQUIREMENTS.

SECTION 300. CLASSIFICATION OF OCCUPANCIES.

300.1. Classes designated.

For the purposes of this code, occupancies of buildings and structures or portions thereof are classified as assembly occupancy, business occupancy, educational occupancy, high hazard occupancy, industrial occupancy, institutional occupancy, mercantile occupancy, residential occupancy and storage occupancy.

(a) **Assembly Occupancy** means the occupancy or use of a building or structure or any portion thereof by a gathering of persons for civic, political, travel, religious, social or recreational purposes; including among others,

armories	dance halls	opera houses
assembly halls	exhibition rooms	passenger stations
auditoriums	gymnasiums	pool rooms
bowling alleys	lecture halls	recreation areas
broadcasting studios	lodge rooms	restaurants
chapels	motion picture	skating rinks
churches	theatres	television studios
club rooms	museums	theatres
	night clubs	

(b) **Business Occupancy** means the occupancy or use of a building or structure or any portion thereof for the transaction of business, or the rendering or receiving of professional services; including among others,

banks	offices	telephone
barber shops	radio stations	exchanges
beauty parlors		television stations

(c) **Educational Occupancy** means the occupancy or use of a building or structure or any portion thereof by persons assembled for the purpose of learning or of receiving educational instruction; including among others,

academies	libraries	schools
colleges		universities

(d) **High Hazard Occupancy** means the occupancy or use of a building or structure or any portion thereof that involves highly combustible, highly flammable, or explosive material, or which

has inherent characteristics that constitute a special fire hazard; including among others,

aluminum powder factories	gasoline bulk plants
cellulose nitrate plastic	grain elevators
factories, warehouses and	lacquer factories
sales rooms	liquefied petroleum gas charging or bulk storage plants
cereal mills	mattress factories
distilleries	paint factories
explosives manufacture,	waste paper plants
sales and storage	
flour and feed mills	

(e) **Industrial Occupancy** means the occupancy or use of a building or structure or any portion thereof for assembling, fabricating, finishing, manufacturing, packaging or processing operations; except when classed as a high hazard occupancy; including among others,

assembly plants	laboratories	processing plants
creameries	laundries	pumping stations
electric substations	manufacturing	repair garages
factories	plants	smoke houses
ice plants	mills	work shops
	power plants	

(f) **Institutional Occupancy** means the occupancy or use of a building or structure or any portion thereof by persons harbored or detained to receive medical, charitable or other care or treatment, or by persons involuntarily detained; including among others,

asylums	infirmaries	penal institutions
homes for the aged	jails	reformatories
hospitals	nurseries	sanitariums
houses of correction	orphanages	

(g) **Mercantile Occupancy** means the occupancy or use of a building or structure or any portion thereof for the displaying, selling or buying of goods, wares or merchandise; except when classed as a high hazard occupancy; including among others,

department stores	motor vehicle	stores
markets	service garages	supermarkets

(h) **Residential Occupancy** means the occupancy or use of a building or structure or any portion thereof by persons for whom sleeping accommodations are provided but who are not harbored or detained to receive medical, charitable or other care or treatment, or are not involuntarily detained; including among others,

apartments	dormitories	motels
club houses	dwellings	multifamily
convents	hotels	houses
	lodging houses	

(i) **Storage Occupancy** means the occupancy or use of a building or structure or any portion thereof for the storage of goods, wares, merchandise, raw materials, agricultural or manufactured products, including parking garages, or the sheltering of live stock and other animals; except when classed as a high hazard occupancy.

300.2. Mixed occupancy.

Where two or more occupancies of different classes are within the same building or structure the provisions of this code applying to each class of occupancy shall apply to the parts of the building or structure that are occupied by that class; and if there should be conflicting provisions, the requirements securing the greater safety shall prevail.

300.3. Doubtful classification.

Where an occupancy or use is not specifically provided for, or where there is any uncertainty as to its classification it shall be placed in the classification that most nearly resembles it with respect to life and fire hazards.

SECTION 310. SPECIAL OCCUPANCY REQUIREMENTS.

The following occupancies shall, in addition to conforming to all other requirements of this code, conform to the special occupancy requirements in the following sections:

- Business Occupancies. (Section 311)
- Educational Occupancies. (Section 312)
- Institutional Occupancies. (Section 313)
- High Hazard Occupancies. (Section 314)
- Bowling Alleys. (Section 315)
- Garages. (Section 316)
- Multifamily Houses. (Section 317)
- Separation of Mercantile Occupancies from Residential Occupancies and from Truck Loading and Unloading Areas. (Section 318)
- Places of Assembly, Theatres and Motion Picture Theatres. (Sections 319, 320, 321 and 322)

SECTION 311. BUSINESS OCCUPANCIES.

Outside the fire limits the limiting areas in section 402 may be increased by 50 per cent for one story buildings of noncombustible construction used exclusively for assembly, business or educational occupancies.

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SECTION 312. EDUCATIONAL OCCUPANCIES.

(a) Outside the fire limits the limiting areas in section 402 may be increased by 50 per cent for one story buildings of non-combustible construction used exclusively for assembly, business or educational occupancies.

(b) Educational occupancies for 100 or more occupants shall not be located above the second story in buildings of ordinary construction, unprotected noncombustible construction or wood frame construction; except that existing buildings converted from another occupancy to such occupancy shall be exempt from these restrictions if sprinklered.

SECTION 313. INSTITUTIONAL OCCUPANCIES.

(a) Buildings used for institutional occupancies such as asylums, hospitals, houses of correction, infirmaries, jails, penal institutions and reformatories shall be of fire-resistive construction.

(b) Buildings used for institutional occupancies such as convalescent homes, homes for the aged, nurseries, nursing homes, orphanages and sanitariums, when of other than fire-resistive construction, shall not exceed 2 stories in height and shall have floors and partitions with fire resistance ratings of not less than one hour and with fire retardant ceilings under roofs, and if of wood frame construction shall not exceed one story in height nor 2,500 square feet in area, except that buildings converted from another occupancy to such occupancy shall be exempt from these restrictions if sprinklered.

(c) Corridors in buildings used for institutional occupancies shall be subdivided by smoke-tight partitions at intervals of not more than 150 feet. Doors in such partitions shall be of the swinging, self-closing or automatic closing type and shall be solid wooden doors of flush type not less than $1\frac{3}{4}$ inches nominal thickness, or equivalent, with any glass panels of wired glass.

(d) Hazardous areas such as basements or attics used for the storage of combustible material, workrooms such as carpenter shops, paint shops and upholstery shops, central storerooms such as furniture, mattress and miscellaneous storage, and similar occupancies intended to contain combustible materials which will either be easily ignited, burn with an intense flame or result in the production of dense smoke and fumes, shall be separated from rooms of other occupancy by floors, partitions and ceilings having a fire resistance rating of not less than one hour. Doors in such partitions shall be self-closing solid wooden doors of the flush type not less than $1\frac{3}{4}$ inches nominal thickness covered on the hazardous area side with sheet steel not thinner than 28 gauge, or equivalent.

SECTION 314. HIGH HAZARD OCCUPANCIES.

(a) When a building or structure or the major portion of a building or structure is used for a high hazard occupancy such building or structure or major portion thereof shall comply with nationally recognized good practice for the occupancy on matters not covered in this code.

(b) Buildings or structures or major portions thereof used for a high hazard occupancy for which there is no nationally recognized good practice shall comply with the following provisions in addition to other requirements of this code:

(1) The building or structure shall be of fire-resistive construction or noncombustible construction.

(2) A horizontal separation of not less than 50 feet shall be provided.

(3) Buildings or structures of protected noncombustible construction shall not exceed 2 stories in height and buildings or structures of unprotected noncombustible construction shall not exceed one story in height.

SECTION 315. BOWLING ALLEYS.

Portions of buildings in which 3 or more bowling alleys are located shall be separated from other occupancies by walls, partitions, floors and ceilings having a fire resistance rating of not less than one hour.

SECTION 316. GARAGES.**316.1. Open air parking garages.**

(a) Open air parking garages shall be of fire-resistive construction, of protected noncombustible construction or of unprotected noncombustible construction.

(b) Open air parking garages which exceed 2,500 square feet in area shall not have open sides along and within 15 feet of any lot line along which buildings are or may be built, nor within 15 feet of another building of wood frame construction or unprotected noncombustible construction on the same lot, nor within 15 feet of any openings in another building on the same lot.

(c) Open air parking garages shall not exceed 75 feet in height nor 30,000 square feet in area when of protected noncombustible construction and shall not exceed 50 feet in height nor 20,000 square feet in area when of unprotected noncombustible construction.

(d) Open air parking garages shall not be located within or attached to a building used for any other occupancy unless separated from the other occupancies as required in sections 316.3 and 316.4 for enclosed parking garages.

(e) Lifts to transport only employees may be installed in open air parking garages. Such lifts need not be enclosed but shall be protected from floor to ceiling in each story with wire mesh or other approved material. Approved devices shall be installed to prevent use of the lifts by persons other than employees.

(f) Ramps connecting floors of garages, which are not considered as required exit ways under section 602 or 603, need not be enclosed.

(g) Where enclosure walls are omitted, no glass, tarpaulins or other enclosing material shall be permitted.

(h) Adequate curbs and guard rails approved by the building official shall be provided at openings in exterior walls in open air parking garages other than those in which cars are mechanically parked

316.2. Enclosed parking garages not exceeding 750 square feet in area.

(a) An enclosed parking garage not exceeding 750 square feet in area shall not be located within or attached to a building used for any other occupancy, except industrial occupancy, unless separated from the other occupancies by walls, partitions, floors and ceilings of materials to restrict the passage of gases, smoke and odor from the garage to the other occupancies. The garage need not be so separated from industrial occupancies.

(b) There shall be no opening from the garage into rooms used for sleeping purposes.

316.3. Enclosed parking garages between 750 and 3,000 square feet in area.

(a) An enclosed parking garage between 750 and 3,000 square feet in area shall not be located within or attached to a building used for any other occupancy unless separated from the other occupancies by walls, partitions and floor and ceiling assemblies having a fire resistance rating of not less than one hour. Openings from the garage into spaces used for other occupancies shall be provided with approved self-closing fire doors. There shall be no opening from the garage into rooms used for sleeping purposes.

(b) Floor surfaces shall be of noncombustible material and shall be without pits or depressions.

(c) Garages located in basements shall be ventilated by a mechanical ventilating system with positive means for both the inlet and exhaust of at least one cubic foot of air per minute per square foot of floor area. Control of the exhaust and inlet fans shall be close to the entrance door. The ventilating equipment may be combined with the heating system.

(d) Ramps connecting floors of garages, which are not considered as required exit ways under section 602 or 603, need not

be enclosed in garages of fire-resistive construction or noncombustible construction nor in sprinklered garages.

316.4. Enclosed parking garages exceeding 3,000 square feet in area.

(a) An enclosed parking garage exceeding 3,000 square feet in area shall not be located within or attached to a building used for any other occupancy unless separated from the other occupancies by walls, partitions and floor and ceiling assemblies of noncombustible material having a fire resistance rating of not less than 2 hours. Where a salesroom, showroom or office not exceeding 1,500 square feet in area is operated in connection with such garage the walls, partitions and floor and ceiling assemblies separating the garage from such salesroom, showroom or office are not required to have a fire resistance rating but shall be of materials to restrict the passage of gases, smoke, and odor from the garage to the salesroom, showroom or office.

(b) Openings from the garage into spaces used for other occupancies shall be provided with approved self-closing fire doors, except in openings from the garage into a salesroom, showroom or office not exceeding 1,500 square feet in area and operated in connection with the garage.

(c) Floor surfaces shall be of noncombustible material and shall be without pits or depressions.

(d) Garages located in basements shall be ventilated by a mechanical ventilating system with positive means for both the inlet and exhaust of at least one cubic foot of air per minute per square foot of floor area. Control of the exhaust and inlet fan shall be close to the entrance door. The ventilating equipment may be combined with the heating system.

(e) Ramps connecting floors of garages, which are not considered as required exit ways under section 602 or 603, need not be enclosed in garages of fire-resistive construction or noncombustible construction nor in sprinklered garages.

316.5. Repair garages.

(a) Repair garages shall not be located within or attached to a building used for any other occupancy unless separated from the other occupancies by walls, partitions and floor and ceiling assemblies of noncombustible material having a fire resistance rating of not less than 2 hours. Where a salesroom, showroom or office not exceeding 1,500 square feet in area is operated in connection with such garages the walls, partitions and floor and ceiling assemblies separating the repair garage from such salesrooms, showrooms or offices are not required to have a fire resistance rating but shall be of materials to restrict the passage of gases, smoke and odor from the repair garage to the salesroom, show-

room or office. Repair garages shall not be located in any basement.

(b) Walls, partitions and floor and ceiling assemblies separating the garage from other occupancies shall be without openings except that door openings equipped with approved self-closing fire doors leading to salesrooms or offices that are operated in connection with such garages shall not be prohibited. Entrance from the garage to rooms or spaces used for other occupancies shall be by vestibules or balconies constructed and arranged as required by section 605.4, for horizontal exits.

(c) Floors shall be of noncombustible material that may be readily cleaned and shall be without pits or depressions except for repair pits.

SECTION 317. MULTIFAMILY HOUSES.

(a) The building height limit given in table 401 for ordinary construction may be increased to 65 feet for multifamily houses when the first floor of the building has a fire resistance rating of not less than 2 hours or is of noncombustible material placed directly on the ground, and the other floors have a fire resistance rating of not less than one hour and floors are subdivided into areas not exceeding 3,500 square feet by partitions of noncombustible material having a fire resistance rating of not less than 2 hours.

(b) Multifamily houses of wood frame construction shall not exceed the height limits given in table 401 nor shall they exceed 2 stories in height except that if sprinklered they may be 3 stories in height.

(c) In multifamily houses dwelling units shall be separated from each other and from hallways and other occupancies by partitions and floor and ceiling assemblies having a fire resistance rating of not less than one hour; except that in row houses only the walls and partitions separating each two-family section are required to have a fire resistance rating of not less than one hour. Openings shall be equipped with solid wood doors of the flush type of $1\frac{3}{4}$ inches nominal thickness or equivalent.

SECTION 318. SEPARATION OF MERCANTILE OCCUPANCIES FROM RESIDENTIAL OCCUPANCIES AND FROM TRUCK LOADING AND UNLOADING AREAS.

(a) In buildings of other than fire-resistive construction portions classified as mercantile occupancy shall be separated from portions classified as residential occupancy by walls, partitions and floor and ceiling assemblies having a fire resistance rating of not less than one hour.

(b) A truck loading or unloading area within a building used for a mercantile occupancy shall be separated from other parts of the building by walls, partitions and floor and ceiling assemblies having a fire resistance rating of not less than one hour, and any load bearing element of the building within the loading or unloading area shall have a fire resistance rating of not less than one hour or be of heavy timber construction.

SECTION 319. PLACES OF ASSEMBLY, THEATRES AND MOTION PICTURE THEATRES.

319.1. Area modification.

Outside the fire limits the limiting areas in section 402 may be increased by 50 per cent for one story buildings of noncombustible construction used exclusively for assembly, business or educational occupancies.

319.2. Construction.

(a) Buildings used for theatres and motion picture theatres shall be of fire-resistive construction, except that portions of such buildings not over 1 story or over 45 feet in height may have roofs of heavy timber construction or of an assembly having a fire resistance rating of not less than one hour.

(b) No theatre or motion picture theatre shall be located within or attached to a building used for any other occupancy unless separated from such other occupancies by walls and floor and ceiling assemblies of noncombustible material having a fire resistance rating of not less than 3 hours.

(c) Places of assembly shall not be located above the second story in buildings of wood frame construction, ordinary construction or unprotected noncombustible construction. Where places of assembly are located in the second story all floors other than those above the second story shall have a fire resistance rating of not less than one hour.

319.3. Seating arrangements.

(a) In places of assembly seating more than 200 occupants and in which seats in rows are provided, seats shall be securely fastened to the floor; except that in churches and other places of religious assembly, in railed-in boxes or loges having not more than 14 seats, in reviewing stands, in auditoriums used for gymnasium purposes and in places of assembly where seats are not provided in rows, seats need not be securely fastened to the floor. Where seats are not securely fastened to the floor adequate aisles to reach exit ways shall be maintained at all times, and not more than one seat shall be provided for each 15 square feet of floor area used for seating in places of assembly where seats are not provided in

rows and not more than one seat shall be provided for each 6 square feet of floor area used for seating in other places of assembly.

(b) The capacity of seats without dividing arms shall be determined by allotting 18 inches per occupant.

(c) The maximum number of seats in any row extending from one aisle to another shall be 14 and the maximum number of seats in any row opening on to an aisle at only one end shall be 7. The number of seats in a row may be increased to 100 where seats are so spaced that there is an unobstructed space of not less than 18 inches horizontal projection between the rows of seats, and doorways leading directly to exit corridors are provided along each side of the place of assembly at the rate of one doorway for every 3 rows of seats.

(d) Seats in rows, whether fixed or movable, shall, except in boxes or loges having not more than 14 seats, be not less than 30 inches apart from back to back nor less than 27 inches plus the sum of the thickness of the back and inclination of the back. There shall be a space of not less than 12 inches between the back of one seat and the front of the seat immediately behind it as measured between plumb lines.

319.4. Aisles.

(a) Every aisle shall lead to a door opening onto an exit way, or to a cross aisle, that is, an aisle running parallel with the seat rows and leading to a door opening onto an exit way.

(b) The unobstructed width of an aisle accommodating 60 or more occupants shall be not less than 36 inches. The unobstructed width of an aisle accommodating less than 60 occupants shall be not less than 30 inches.

(c) The unit of width used as a measure of exit capacity for aisles shall be 22 inches. Fractions of a unit shall not be included except that an allowance of one-half unit may be made for 12 inches of aisle width added to one or more 22-inch units of such width. The number of occupants that may be accommodated per unit of such width shall be 100 for places of assembly on the ground or street floor and 80 for other places of assembly.

(d) Steps shall not be placed in aisles unless the gradient would otherwise exceed one foot rise in 10 feet run. Steps, when necessary, shall be grouped, and so far as practicable isolated steps shall be avoided. Such steps shall extend across the full width of the aisles and shall be illuminated; treads and risers shall conform to the requirements for exit stairs in section 604.6.

(e) Aisles shall be used only for passage to and from seats and shall be kept unobstructed at all times.

319.5. Railings.

(a) The facias of boxes, balconies and galleries shall have substantial railings not less than 26 inches high above the floor. The railings at the ends of aisles extending to the facia shall be not less than 30 inches high for the width of the aisle, or 36 inches high if at the foot of steps.

(b) Cross aisles, except where the backs of seats on the front of the cross aisles project 24 inches or more above the floor of the cross aisle, shall be provided with railings not less than 26 inches high.

319.6. Grandstands and places of outdoor assembly.

Grandstands, including the foldable, portable and permanent types used indoors or outdoors, and unenclosed places of assembly such as stadiums and reviewing stands, shall conform with nationally recognized good practice.

SECTION 320. STAGES IN PLACES OF ASSEMBLY.**320.1. General.**

(a) No stage designed or used for the presentation of theatrical or similar performances, including drama, opera, vaudeville and the like, which use theatrical type scenery, shall be erected, or placed in a place of assembly except in conformity with the provisions of this section.

(b) Every such stage now existing, if reconstructed or altered, shall be made to conform with the provisions of this section.

320.2. Enclosure walls.

(a) Such stage shall be separated from all other parts of the building by walls of noncombustible material having a fire resistance rating of not less than 2 hours and with openings protected as required in sections 320.4 and 321; except that in motion picture theatres, school auditoriums, clubs and similar places of assembly, where the stage or platform does not exceed 10 feet in depth and is without provisions for scenery, separating walls between the stage and the auditorium shall not be required. Such separating walls shall extend from the foundation to at least 4 feet above the roof, except where the roof is of fire-resistant construction, in which case the walls shall be carried up tightly against the underside of the roof.

(b) There shall be no window opening in such stage enclosure wall within 5 feet of a lot line other than a street line.

320.3. Construction.

(a) All that portion of the stage, except that used for the working of scenery, traps and other mechanical apparatus for the presentation of a scene, approximately equal to the width of the

proscenium opening, and all appurtenant rooms and compartments shall be of fire-resistive construction.

(b) The rigging loft and entire fly galleries, including pin rails, shall be of noncombustible material.

(c) The roof over the stage shall be of fire-resistive construction.

320.4. Doors and windows.

(a) Door openings leading from the stage directly to the outer air shall be equipped with approved self-closing fire doors. Door openings in the proscenium wall shall be equipped with approved self-closing fire doors. All other door openings connecting with the stage shall be equipped with approved automatic or self-closing fire doors.

(b) Windows shall be approved fire windows.

320.5. Appurtenant rooms.

(a) Dressing rooms, scene docks, property rooms and other rooms or compartments appurtenant to the stage shall be separated from other parts of the building by partitions of noncombustible material having a fire resistance rating of not less than 2 hours.

(b) Such rooms shall be separated from the stage by partitions of noncombustible material having a fire resistance rating of not less than 2 hours and shall have floors and roofs of fire-resistive construction.

(c) In no case shall openings other than the necessary doorways at the stage level, connect such rooms with the rest of the stage.

(d) No such room shall be placed over the stage.

(e) Dressing rooms shall have exit ways independent of the auditorium exit ways.

(f) Unless they are ventilated by windows in conformity with the requirements of Article V, dressing rooms shall be ventilated by a mechanical air conditioning or ventilating system providing not less than 6 changes of air per hour.

(g) All shelving and closets in dressing rooms, property rooms or storage rooms shall be constructed of noncombustible material.

320.6. Smoke vents.

(a) Over the stage there shall be provided one or more ventilators of metal or other noncombustible material, equipped with movable shutters or sash, having an aggregate clear area of not less than $\frac{1}{8}$ the area of the stage, constructed to open automatically and instantly by approved heat-actuated devices. Where the stage does not have a rigging loft or fly gallery the vent area

may be 1/12 the area of the stage. Suitable means for manual operation shall be provided in addition.

(b) If glass is used in the construction, only wired glass or glass blocks shall be used in such parts where the breaking of glass would cause it to fall on the stage.

320.7. Lights.

(a) The troughs or frames for footlights and border lights shall be of noncombustible material.

(b) The suspension lines of border lights shall be of wire for at least 10 feet from the frames.

320.8. Location of electrical switchboard.

The switchboard for the electrical equipment of the stage shall be so located that it will be accessible at all times, and will be protected from falling objects and from the storage or placing of stage equipment against it.

320.9. Sprinklers required.

Approved automatic sprinkler systems shall be provided under the roof of the stage and in all other locations on the stage side of the proscenium opening such as under the gridiron, the rigging loft and fly and tie galleries, under the stage, in dressing rooms, scene docks, workshops and storage rooms.

SECTION 321. PROSCENIUM CURTAIN.

321.1. In places of assembly for less than 1,000 occupants.

(a) In places of assembly for less than 1,000 occupants proscenium openings of stages covered by section 320 shall be protected with a proscenium curtain complying with this section.

(b) The curtain shall be of asbestos cloth weighing not less than 3 pounds per square yard and having not less than 180 pounds strength per inch width of warp and 85 pounds strength per inch width of filling. Cotton or other combustible fiber in the cloth shall not exceed 5 per cent of the weight of the asbestos. The cloth shall be filled with a mineral paint composed of 4 parts casein to 10 parts of water glass with water added in suitable proportions. Other paints which will completely fill the pores of the cloth and which are capable of withstanding fire without giving out more smoke than such mineral paint shall be permitted.

(c) The weight of the curtain shall be sufficiently in excess of the counterweights to overcome all friction, so that the curtain will drop freely by gravity. The speed shall be so regulated that the closure of the opening shall be effected within thirty seconds; provided that the last five feet of travel shall require not less than five seconds and the curtain shall settle on the stage floor without shock. Its operation shall be controlled by at least three heat-

actuated releasing devices, of which there shall be one at each side of the proscenium opening near the stage floor, any one of which would release the curtain in case of fire. In addition there shall be an emergency device so arranged that the curtain can be released for closing by hand from either side of the stage.

(d) The hoisting apparatus for the curtain shall be designed with a factor of safety of eight. No part of the curtain shall be supported or fastened to combustible material.

(e) The curtain shall be of sufficient width and height to overlap the proscenium opening 2 feet at the top and 18 inches at each side. It shall slide at each side in a rigid steel groove which shall have a minimum depth of 12 inches. The grooves or guide members at the sides of the proscenium opening shall be structural steel shapes and shall be of such design as to form a continuous smoke seal from top to bottom, with a clearance of not over three-eighths inch. The guides shall be installed in such manner that in case of fire on the stage the pressure of heated gases against the curtain will act to close the guide joints tightly. The curtain grooves shall be securely fastened to the proscenium wall and the curtain shall be retained in the guiding channels at all times. A smoke seal shall be provided not less than two feet above the proscenium opening for the top of the curtain and eighteen inches at each side.

(f) The bottom of the curtain shall be weighted with pipe battens or other weights held in pockets sewed in the curtain and shall have a yielding pad of noncombustible material not less than 3 inches thick to form a seal against the stage floor.

(g) Curtains of other designs and materials may be used when satisfactory proof has been submitted to the building official that such design and material meets the requirements of this section as to strength, fire resistance and smoke-tightness when subjected to a fire test with exposing temperatures reaching not less than 1,400 degrees F. at the end of 15 minutes.

(h) Complete details of any proposed proscenium curtain and curtain installation, including mechanism and structural supports, shall be submitted to the building official and approval shall be obtained before erection is started. After completion, operating tests of the curtain shall be made and approval of its functioning obtained before a public performance is staged.

321.2. In places of assembly for 1,000 or more occupants.

(a) In places of assembly for 1,000 or more occupants proscenium openings of stages covered by section 320 shall be protected with a proscenium curtain complying with this section.

(b) The proscenium opening shall be provided with an asbestos cloth curtain constructed on a rigid steel frame, having a lap of 2 feet at the top and 18 inches at each side, sliding at each

side in a rigid steel groove, which shall have a minimum depth of 12 inches. The cloth shall be placed on the front and back edges of the framework with the joints properly sealed. The thickness of the curtain shall be not less than 1/120 of the width of the proscenium opening nor less than four inches in any case.

(c) The asbestos cloth shall be reinforced with wire of nickel, nickel alloy, brass, or other metal alloy having not less strength at a temperature of 1,700 degrees F. and not less resistance to corrosion at ordinary temperature, spun into the yarn. The cloth shall weigh not less than 3 pounds per square yard and have not less than 180 pounds strength per inch width of warp and 85 pounds strength per inch width of filling. Cotton or other combustible fiber in the cloth shall not exceed 5 per cent of the weight of the asbestos. The cloth shall be filled with a mineral paint composed of 4 parts casein to 10 parts of water glass with water added in suitable proportions. Other paints which will completely fill the pores of the cloth and which shall be capable of withstanding fire without giving out more smoke than such mineral paint shall be permitted.

(d) The weight of the curtain shall be sufficiently in excess of the counterweights to overcome all friction, so that the curtain will drop freely by gravity. The speed shall be so regulated that the closure of the opening shall be effected within thirty seconds; provided that the last five feet of travel shall require not less than five seconds and the curtain shall settle on the stage floor without shock. Its operation shall be controlled by at least three heat-actuated releasing devices, of which there shall be one at each side of the proscenium opening near the stage floor, any one of which would release the curtain in case of fire. In addition there shall be an emergency device so arranged that the curtain can be released for closing by hand from either side of the stage.

(e) The curtain shall be suspended by not less than four steel lifting cables. Two of the suspension points shall be at the extreme ends of the curtain, and the others shall be placed at such points as best suit the design; but in no case shall the distance between any two points of support exceed ten feet. The hoisting apparatus for the curtain shall be designed with a factor of safety of eight. No part of the curtain shall be supported or fastened to combustible material.

(f) The curtain shall be of sufficient width and height to overlap the proscenium opening 2 feet at the top and 18 inches at each side. It shall slide at each side in a rigid steel groove which shall have a minimum depth of 12 inches. The grooves or guide members at the sides of the proscenium opening shall be structural steel shapes and shall be of such design as to form a continuous smoke seal from top to bottom, with a clearance of not

over three-eighths inch. The guides shall be installed in such manner that in case of fire on the stage the pressure of heated gases against the curtain will act to close the guide joints tightly. The curtain grooves shall be securely fastened to the proscenium wall and the curtain shall be retained in the guiding channels at all times. A smoke seal shall be provided not less than two feet above the proscenium opening for the top of the curtain and eighteen inches at each side.

(g) Curtains of other designs and materials may be used when satisfactory proof has been submitted to the building official that such design and material meets the requirements of this section as to strength, fire resistance and smoke-tightness when subjected to a fire test with exposing temperatures reaching not less than 1,700 degrees F. at the end of 15 minutes.

(h) Complete details of any proposed proscenium curtain and curtain installation, including mechanism and structural supports, shall be submitted to the building official and approval shall be obtained before erection is started. After completion, operating tests of the curtain shall be made and approval of its functioning obtained before a public performance is staged.

SECTION 322. ENCLOSURES FOR MOTION PICTURE PROJECTORS.

(a) Motion picture projectors using cellulose nitrate film shall be operated or set up for operation only within an approved enclosure, not less than 8 feet wide, 10 feet deep and 8 feet high for one projection machine, and not less than 14 feet wide, 10 feet deep and 8 feet high for 2 machines.

(b) The walls and ceilings of the enclosure shall be of a form of construction having a fire resistance rating of not less than one hour. All joints shall be sufficiently tight to prevent the discharge of smoke.

(c) The enclosure shall have at least 2 doors opening onto exit ways each not less than 30 inches wide and 6 feet high, protected by an approved self-closing fire door.

(d) Two openings for each motion picture projector shall be provided; one for the projectionist's view (observation port) shall be not larger than 200 square inches, and the other through which the picture is projected (projection port) shall be not larger than 120 square inches. Where separate stereopticon, spot or flood light machines are installed in the same enclosure with picture machines, not more than one opening for each such machine shall be provided for both the operator's view and for the projection of the light, but two or more machines may be operated through

the same opening; such openings shall be as small as practicable and shall be capable of being protected by approved automatic shutters.

(e) Each opening shall be provided with an approved gravity shutter set into guides not less than one inch at sides and bottom, and overlapping the top of the opening by not less than one inch when closed. Shutters shall be of not less than 10-gauge iron or its equivalent, or of $\frac{1}{4}$ -inch hard asbestos board. Guides shall be of not less than 10-gauge iron or its equivalent. Each shutter shall have a fusible link above it, and there shall also be one located over each upper projector magazine which, upon operating, will close all the shutters. There shall also be provided suitable means for manually closing all shutters simultaneously from a point within the projection room near each exit door. Shutters on openings not in use shall be kept closed.

(f) All shelves, furniture and fixtures within the enclosure shall be constructed of noncombustible material.

(g) Ventilation shall be provided by one or more mechanical exhaust systems which shall draw air from each arc lamp housing and from one or more points near the ceiling. Systems shall exhaust to outdoors either directly or through a noncombustible flue used for no other purpose. Exhaust capacity shall be not less than 15 cubic feet nor more than 50 cubic feet per minute for each arc lamp plus 200 cubic feet per minute for the room itself. Systems shall be controlled from within the enclosure and have pilot lights to indicate operation. The exhaust system serving the projection room may be extended to cover rooms associated therewith such as re-wind rooms, but ventilation of these rooms shall not be connected in any way with ventilating or air conditioning systems serving other portions of the building.

(h) Exhaust ducts shall be of noncombustible material, and shall either be kept one inch from combustible material or covered with $\frac{1}{2}$ -inch of noncombustible heat insulating material.

(i) Fresh air intakes other than those direct to the open air shall be protected by approved fire shutters arranged to operate automatically with the port shutters.

(j) Provision shall be made so that the auditorium lights can be turned on from inside the projection room and from at least one other convenient point in the building.

ARTICLE IV.

RESTRICTIONS WITHIN THE FIRE LIMITS, HEIGHT
AND AREA RESTRICTIONS AND STREET ENCROACH-
MENTS.SECTION 400. RESTRICTIONS ON CONSTRUCTION
WITHIN THE FIRE LIMITS.

400.1. General restrictions.

Except as otherwise provided in section 400.5, no building or structure of wood frame construction or of unprotected noncombustible construction shall be erected within the limits established by law as the Fire Limits nor shall wood or other combustible veneers be permitted on buildings or structures within such Fire Limits.

400.2. Alterations and extensions.

(a) Within the fire limits no building or structure of wood frame construction or of unprotected noncombustible construction shall be increased in height.

(b) Within the fire limits no building or structure shall be extended on any side by wood frame construction or unprotected noncombustible construction. When extensions are made to a building or structure of wood frame construction or unprotected noncombustible construction, the aggregate area of the building or structure including the extension shall not exceed the allowable area for wood frame construction in table 402 and section 402.3.

(c) Nothing in this section shall be construed to prohibit other alterations within the fire limits; provided there is no change of occupancy to a class of occupancy otherwise prohibited.

400.3. Moving buildings.

No building or structure of wood frame construction or unprotected noncombustible construction shall be moved from without to within the fire limits or from one lot to another within the fire limits.

400.4. Buildings partly within fire limits.

A building or structure shall be deemed to be within the fire limits if one-third or more of the area of such building or structure is located therein.

400.5. Exceptions to restrictions within fire limits.

Nothing in this section shall prohibit within the fire limits and subject to the specified limitations, the erection of new buildings or structures nor the extension or enlargement of buildings or structures of wood frame construction or unprotected noncombustible construction nor the use of wood or other combustible veneers as follows:

(a) Wood or other combustible veneers on noncombustible backing for show windows that do not extend above the first full story above grade.

(b) A building occupied as a private garage, not more than one story in height nor more than 750 square feet in area, located on the same lot with a dwelling; provided that such building shall be placed at least 3 feet from the lot lines of adjoining property.

(c) Buildings of unprotected noncombustible construction, except when used for a high hazard occupancy, not exceeding 2,500 square feet in area when used for a business occupancy or 1,000 square feet in area when used for other occupancies, nor more than one story in height, and having a horizontal separation of not less than 10 feet on all sides. Walls having a horizontal separation of less than 10 feet shall have a fire resistance rating of not less than one hour.

(d) Enclosed and open air parking garages complying with section 316, of unprotected noncombustible construction.

(e) Greenhouses not more than 15 feet in height erected on the same lot with and accessory to a dwelling or a store.

(f) Sheds open on the long side, not more than 15 feet in height nor more than 500 square feet in area, located at least 5 feet from buildings and from adjoining lot lines.

(g) Builders' shanties for use only in connection with a duly authorized building operation and located on the same lot with such building operation, on a lot immediately adjoining, on an upper floor of the building under construction, or on a sidewalk shed.

(h) Piazzas or balconies on dwellings, not exceeding 10 feet in width nor extending more than 3 feet above the second-story floor beams; provided that no such structure shall be located nearer than 3 feet to an adjoining lot line or be joined to a similar structure of another building.

(i) Fences not exceeding 10 feet in height.

(j) Display signs as provided in Article XVI.

(k) Cooling towers as provided in section 805.7

(l) Roofs over parking lots and bus stations, of unprotected noncombustible construction, where the roof is at least 10 feet above the floor, and every 40 feet there is an open roof ventilation area 6 feet wide extending either the full length of the roof or the full width of the roof.

SECTION 401. HEIGHT RESTRICTIONS.

401.1. New buildings.

No building shall be erected to exceed in height the limits of table 401.

401.2. Alterations.

No building shall be altered to exceed in height the limits of table 401.

401.3. Appurtenances excepted.

For the purpose of this section, the following appurtenances shall not be deemed parts of buildings: church spires, tanks and their supports, roof structures, chimneys, signs attached to the building, radio and television masts, water cooling towers for air conditioning or other apparatus, and parapets that do not extend more than 4 feet above the roof surface at their point of contact.

TABLE 401

See section 310 for height limits for certain special occupancies.

See section 400 for height limits of unprotected noncombustible construction and wood frame construction within the fire limits.

<i>Types of Construction</i>	<i>Height</i>
Fire-Resistive—Type A	No limit
Fire-Resistive—Type B (see note(b))	85 feet
Protected Noncombustible.....	75 feet
Heavy Timber.....	65 feet
Ordinary (see note (a)).....	45 feet
Unprotected Noncombustible (see note (a)).....	35 feet
Wood Frame	35 feet

Note (a) Where the first floor of a building of ordinary or unprotected noncombustible construction has a fire resistance rating of not less than 2 hours or is of noncombustible material and is placed directly on the ground, the allowable height of such building may be increased by 10 feet.

Note (b) Buildings of fire-resistive—type B construction may be of unlimited height provided those portions of buildings above 85 feet are used for business or residential occupancies.

SECTION 402. FLOOR AREA RESTRICTIONS.**402.1. New buildings.**

(a) The floor area enclosed by exterior walls or by exterior walls and fire walls in any story of a building shall not exceed the limits of table 402 and section 402.3.

(b) For the purpose of this section loading platforms, sheds and similar structures open on the long side and attached to buildings located outside the fire limits shall not be deemed parts of the buildings if the aggregate area of such loading platforms, sheds and similar structures does not exceed the area limits of table 402 for buildings of the same type of construction.

(c) The aggregate area of buildings or portions of buildings not of fire-resistive construction attached to buildings of fire-

resistive construction shall not exceed the allowable area for any of the buildings or portions of buildings not of fire-resistive construction.

(d) Where 2 or more buildings not of fire-resistive construction are connected by enclosed bridges, corridors, tunnels or other similar connections and the aggregate area of the buildings so connected exceeds the allowable area of any of the buildings, the openings onto such interconnections between the buildings shall be restricted to doorways or other openings protected by approved self-closing fire doors. The construction of the bridges, corridors, tunnels or other similar connections between the buildings shall be of noncombustible construction or equivalent to the type of construction of the building having the highest allowable area.

402.2. Alterations.

No building shall be altered so that the floor area in any story exceeds the limits of table 402 and section 402.3.

TABLE 402

FLOOR AREA LIMITS PER STORY OF BUILDINGS IN SQUARE FEET.

See section 400 for floor area limits for buildings of noncombustible and wood frame construction erected within the fire limits.

See section 810 for sprinkler requirements based on occupancy, height and area.

See section 310 for floor area limits for special occupancies.

See section 402.3 for modification of area limits given in the table.

<i>Types of Construction</i>	<i>Area of One story Building</i>	<i>Area of Building over One story</i>
Fire-Resistive—Type A.....	No limit	No limit
Fire-Resistive—Type B.....	No limit	No limit
Protected Noncombustible.....	18,000 sq. ft.	12,000 sq. ft.
Heavy Timber.....	12,000 sq. ft.	8,000 sq. ft.
Ordinary	9,000 sq. ft.	6,000 sq. ft.
Unprotected Noncombustible.....	9,000 sq. ft.	6,000 sq. ft.
Wood Frame.....	6,000 sq. ft.	4,000 sq. ft.

402.3. Area modification.

The area limits of table 402 may be increased in accordance with the following provisions (a) to (g) and, unless specifically prohibited, the increases shall be additive.

(a) Where an entire building is equipped with an approved automatic sprinkler system the limiting areas may be increased by 200 per cent.

(b) Where a one-story building is equipped with an approved automatic sprinkler system and the average height to the roof or to a fire retardant ceiling does not exceed 25 feet, the limiting areas may be increased by 300 per cent. No additional increase because of sprinklers shall be permitted for this condition.

(c) Outside the fire limits the limiting areas of buildings of unprotected noncombustible construction may be increased by 50 per cent when all structural members including walls, columns, piers, beams, girders, joists, trusses, floors and roofs have a fire resistance rating of not less than one hour.

(d) Outside the fire limits the limiting areas of one-story buildings of heavy timber construction, ordinary construction and wood frame construction may be increased 33⅓ per cent when all structural members including columns, wall and partition studs and sheathing, floors and roofs are of approved fire retardant treated lumber that has been treated by a pressure impregnation process.

(e) Outside the fire limits the limiting areas of one-story buildings of ordinary and wood frame construction may be increased 20 per cent when all structural members including walls, columns, beams, girders, joists, floors and roofs have a fire resistance rating of not less than one hour.

(f) Where a building of rectangular shape is erected on a corner lot so that 2 of its sides front on a street or on a public place 21 feet or more in width, unencumbered and accessible from a street, the limiting areas may be increased by 50 per cent.

Where a building is erected on a lot so that all of its sides front on a street or on a public place 21 feet or more in width, unencumbered and accessible from a street, the limiting areas may be increased by 100 per cent.

For any building not covered by the above two paragraphs of this sub-section (f) that has more than 25 per cent of its perimeter fronting on a street or on a public place 21 feet or more in width, unencumbered and accessible from a street, the limiting areas may be increased in accordance with the following formula:

$$I = \frac{2AF}{P} - 0.5A$$

in which:

I = increase of area, in square feet

A = area limit of table 402, in square feet

F = frontage on a street or public place 21 feet or more in width, unencumbered and accessible from a street, in feet

P = building perimeter, in feet

The increase of area permitted by this formula shall not exceed the area limit taken from table 402.

In no case shall any side of a building that does not have suitable access openings, as defined in section 810.1(f), to each story above the basement be given credit as frontage on a street or public place.

(g) Outside the fire limits, buildings of noncombustible construction may be unlimited in area when complying with all the following provisions:

(1) Buildings of protected noncombustible construction shall not exceed 2 stories in height and buildings of unprotected noncombustible construction shall not exceed one story in height without basement.

(2) The entire building shall be equipped with an approved automatic sprinkler system except that buildings occupied exclusively by stocks of noncombustible material not packed or crated in combustible material need not be sprinklered.

(3) A horizontal separation of 80 feet shall be provided on all sides of buildings.

(4) Means of egress shall be provided in accordance with Article VI.

SECTION 403. STREET ENCROACHMENTS.

403.1. General.

Except as otherwise provided in this section, no part of a building or structure shall project beyond a street line or a building line.

403.2. Projections removable.

A part of a building or structure permitted by section 403.4 to project beyond a street line or building line shall be so constructed that its removal may be made without causing the building or structure to become structurally unsafe.

403.3. Structural support.

No part of a building or structure that is necessary for structural safety, shall project beyond a street line or building line, but this shall not be deemed to prohibit the projection beyond the street line or beyond the building line within the street line, to the extent of not more than 12 inches, of the footings of street walls; provided such projecting parts of footings are not less than 8 feet below curb level.

403.4. Permissible projections.

Under the conditions prescribed in this section and within the limitations specified herein, the following projections shall be permissible, it being understood that when a building line has not been established the street line shall control.

(a) The main cornice, meaning thereby a moulded projection at or near the top of a wall that faces on a street, may project beyond the building line not more than 3 feet; provided such main cornice is not less than 12 feet above curb level at all points.

(b) Cornices of show windows and porches, including metal awning covers, may project beyond the building line not more than 15 inches.

(c) Mouldings, belt courses, lintels, sills, architraves, pediments and similar projections of a decorative character, may extend beyond the building line not more than 4 inches when they are less than 10 feet above curb level, and not more than 10 inches when they are 10 feet or more above curb level.

(d) Columns, pilasters and other similar ornamental projections, including their mouldings and bases, erected for esthetic reasons, may project beyond the building line not more than 12 inches.

(e) Rustications and quoins may project beyond the building line not more than 4 inches.

(f) Base courses may project beyond the building line not more than $1\frac{1}{4}$ per cent of the width of the street but not more than 10 inches in any case; provided they do not extend more than 5 feet above curb level.

(g) A door, when fully open, may project not more than 12 inches beyond the building line.

(h) Marquises at entrances to buildings or structures may extend beyond the street line and across the sidewalk to the curb line; provided they are not less than 10 feet above the curb level at all points, and, within the fire limits, are constructed of iron and glass or other noncombustible materials. They shall be securely supported from the building or structure and shall be properly drained.

(i) Awnings attached to buildings or structures may extend beyond the street line but not nearer than 18 inches to the curb line; provided that they are not less than 8 feet above the sidewalk at all points.

(j) Fire escapes and balconies to exits required by sections 602, 603 and 1706, constructed of steel or other noncombustible material, may project beyond the building line not more than 6 feet; but no part of such fire escapes or balconies shall be less than 12 feet above the sidewalk; provided that nothing in this section shall prevent the use, in connection with permissible fire escapes, of movable stairs to the sidewalk, so arranged that they are 12 feet or more above the sidewalk when not in actual use.

(k) Areaways may project beyond the building line not more than 4 feet; provided that every such areaway shall be covered over at the street level by a grating of approved noncombustible material.

(l) Vaults, entirely below the sidewalk level, may extend beyond the street line but not beyond the curb line; provided that every such vault shall be roofed over at the street level by approved masonry, reinforced concrete or steel beams with masonry arches.

(m) Openings in the roofs of vaults under street surfaces shall be provided with substantial covers of noncombustible materials, flush with the top surface and constructed to limit the danger of persons slipping thereon. Covers shall be maintained normally closed, and when open for use shall be fully guarded to prevent accidents.

(n) Glass used in vault lights shall not exceed 16 square inches for one light and shall be of an approved design and shape.

(o) Exterior hose connections for fire extinguishing equipments, and fresh air inlets, shall be set inside the building line; or in recesses in the street walls when such walls are on the building line; or they may project not more than 12 inches beyond the building line through the street wall at least 2 feet above the street level; or they may be placed in the angle made by the street wall with a pilaster or other permissible projection outside the building line.

403.5. Limitation.

Nothing in this section shall be deemed to authorize a projection beyond the street line or building line that is prohibited by other law.

403.6. Permits revocable.

Permission, expressed or implied in the provisions of this section, to construct a building or structure so as to project beyond the street line or building line is revocable by the municipality at will.

403.7. Alterations.

No change or enlargement shall be made to a part of a building or structure projecting beyond the street line or building line, except in conformity with the provisions of this code.

403.8. Existing encroachments.

Existing parts of buildings or structures which project beyond the street line or building line may be maintained as constructed until their removal is directed by the municipality.

ARTICLE V.
LIGHT AND VENTILATION

SECTION 500. GENERAL.

500.1. New buildings.

For the purpose of providing adequate light and ventilation, every building shall be constructed, arranged and equipped to conform to the provisions of this article.

500.2. Alterations.

(a) No building, including existing buildings, shall be altered nor rearranged so as to reduce the size of a room or the amount of window space to less than that required by this article, or so as to create an additional room, unless such additional room is made to conform to the requirements for rooms in this article, except that such rooms may be of the same height as existing rooms in the same story.

(b) No building shall be enlarged, nor shall the lot on which it is located be diminished so that the dimensions of a required court shall be less than prescribed in this code.

500.3. Streets.

For purposes of this article, the term "street" shall include railroad rights-of-way, parks, and waterways.

SECTION 501. ROOMS AND EXIT WAYS.

501. General.

Wherever the following terms are used in this section, they shall be construed as if followed by the words indicated below:

windows—"conforming to section 502."

vent shaft—"conforming to section 503."

ventilating skylights—"conforming to section 504."

mechanical ventilation—"conforming to section 505."

court—"conforming to section 506."

501.2. Habitable rooms.

(a) Every habitable room shall be provided with natural light and ventilation by one or more windows, opening on a street, alley or court.

(b) Such rooms shall be not less than 7 feet wide in any part and shall contain not less than 70 square feet of gross floor area. Such rooms shall have a clear height of not less than 7 feet 6 inches for at least 60 square feet of floor area.

(c) When kitchens serving dwelling units are completely enclosed, the gross floor area shall be not less than 60 square feet and not less than 90 square feet when dining space is included,

except that in dwelling units having no bedrooms the gross area of the kitchen shall be not less than 50 square feet. Kitchens not completely enclosed shall conform to the requirements in section 501.7 for alcoves unless separately lighted and ventilated as required for habitable rooms.

501.3. Rooms for assembly occupancy.

(a) Every room or space used for an assembly occupancy shall be provided with light and ventilation by means of windows or such room or space shall be provided with natural or artificial light and ventilated by an approved means of ventilation.

(b) Where a room or space is used for an assembly occupancy for more than 50 occupants and there is less than 100 cubic feet per occupant, approved mechanical ventilation shall be provided.

(c) Where a room or space is used for an assembly occupancy for 50 or less occupants and there is less than 100 cubic feet per occupant, windows shall be provided on 2 or more sides of the room or space or approved mechanical ventilation shall be provided.

(d) In rooms or spaces used for an assembly occupancy the lighting shall be such during occupancy that the light intensity at every point thirty inches above the floor is not less than 0.5 foot-candle except during a performance requiring dimming or darkness; provided that during the showing of motion pictures where it is the practice for patrons to proceed to and from seats at any time, such light intensity shall be not less than 1/20 of a foot-candle.

501.4. Rooms for institutional occupancy.

Every room used for an institutional occupancy shall be provided with natural light by one or more windows opening on a street, alley or court, and with ventilation by windows as required for habitable rooms or by an approved system of mechanical ventilation; provided that in jails and other detention buildings the opening on such street, alley or court of the windows of cells or similar rooms may be indirect.

501.5. Bathrooms and water-closet compartments.

Every bathroom and every room containing one or more water closets or urinals shall be provided with natural or artificial light, and be ventilated by: one or more windows opening on a street, alley or court; or by a vent shaft which extends to and through the roof or into a court; or by a separate duct of noncombustible and corrosion resistant material, not less than 72 square inches in cross section, extending independently of any duct used for other purposes to and above the roof; or by a ventilating skylight; or by an approved means of mechanical ventilation.

501.6. Service pantries.

Service pantries, except in dwelling units, shall be ventilated as prescribed in section 501.5 for bathrooms.

501.7. Alcoves.

Any alcove opening off a habitable room, unless separately lighted and ventilated, shall be included as part of that room in computing the amount of window area required. The alcove shall have an unobstructed opening between it and the main room of at least 80 per cent of the wall area of the common wall, measured on the alcove side, unless it is separately lighted and ventilated as prescribed for habitable rooms.

501.8. Mezzanine spaces.

In mezzanine spaces, which are open to and form a part of another room, the area of such mezzanine space shall be added to the floor area of the room in which it is located in computing the window area required for both spaces.

501.9. Rooms having special hazards.

Rooms in which, by reason of use or occupancy, dust, fumes, gases, vapors or other noxious or deleterious impurities tending to injure the health of occupants or to create a fire hazard, exist or develop, shall be provided with an approved system of ventilation to remove effectually such impurities during occupancy.

501.10. Other rooms.

Every room or space, other than those specifically provided for in this section, used or occupied by persons, except rooms or spaces used for storage or other purposes with infrequent occupancy, shall be provided with light and ventilation by windows opening on a street, alley or court or shall be provided with one or more ventilating skylights; or such rooms or spaces shall be provided with an approved means of mechanical ventilation.

501.11. Access to rooms and water closets.

(a) In dwellings and multifamily houses access shall be had to every dwelling unit without passing through any other dwelling unit.

(b) In each dwelling unit access without passing through a bedroom shall be provided to at least one water closet, unless every bedroom has direct connection with a water closet or a bathroom having water closet accommodation.

501.12. Exit ways.

(a) Stairways, public halls, corridors and other means of egress, required by sections 602 and 603, except exterior stairways on apartment houses, shall be illuminated at all points to intensities of not less than 1.0 foot-candle at all times that the building served thereby is occupied.

(b) Every stairway, public hall or corridor in multifamily houses and in buildings of institutional occupancy shall be ventilated either by one or more windows opening on a street, alley or court or ventilated by mechanical means approved by the

building official or provided with natural ventilation to the outer air by means of a system of vent flues not less than 12 by 12 inches in size approved by the building official.

(c) If windows are used to provide light and ventilation required by this section, there shall be at least one window or ventilating skylight having a glazed area of not less than 10 square feet for every 20 feet of length or fraction thereof, unless a window is placed at the end of a hall or corridor so that it will adequately light the public hall or corridor for its entire length.

(d) Every recess or return, the depth or length of which exceeds twice the width of the hall or corridor, that is shut off from any other part by a door or doors, shall be deemed a separate hall or corridor within the meaning of this section.

(e) Lights installed to comply with the provisions of this section that are likely to be or to become dangerous in any way to occupants, shall be protected by suitable wire netting or other means against breakage or other hazards.

501.13. Artificial lighting for exit ways.

(a) Artificial lighting shall be provided whenever natural lighting is inadequate.

(b) The lighting required for exit ways by section 501.12 shall be by electricity so arranged and supplied that in the event of failure of the general building lighting, current will be available to maintain the required lighting for exit ways from:

(1) Places of assembly except churches used exclusively for religious purposes and places of assembly where assembly room floor area does not exceed 7,000 square feet and where all exit ways lead directly to the outside of the building with exit doors within 5 feet of grade level and where there are no balconies in assembly room.

(2) Mercantile occupancies 2 or more stories in height and exceeding 5,000 square feet in area on any floor.

(3) Hotels with sleeping accommodations for more than 100 occupants.

(4) Hospitals, sanitariums, homes for the aged and asylums for more than 100 occupants.

SECTION 502. WINDOWS.

502.1. Glazed area.

The aggregate area of approved glazing material in windows required by section 501 shall be not less than 1/10 of the floor area of the room served by them; in habitable rooms such glazed area shall be not less than 10 square feet, and in bathrooms it shall be not less than 3 square feet.

502.2. Glazing.

Only wired glass not less than $\frac{1}{4}$ inch thick shall be used for the glazing of fire windows. Other windows shall be glazed with glass or other translucent or transparent material having a flame spread rating not greater than permitted for interior finish materials in section 808.

502.3. Openings.

Windows or other openings required for ventilation shall have an aggregate openable area of at least 50 per cent of the glazed area required for lighting.

SECTION 503. VENT SHAFTS.**503.1. Size.**

Vent shafts installed to meet requirements of section 501.5 or 501.6 shall have a cross-sectional area of not less than $\frac{1}{2}$ of a square foot for every bathroom or water closet vented by the shaft, but not less than 9 square feet in any case. No such shaft shall be less than 2 feet in its least dimension.

503.2. Skylights.

Unless open to the outer air at the top for its full area, such shaft shall be covered by a skylight glazed and protected as specified in section 805.4 and having a net area of permanent openings equal to the maximum required shaft area.

503.3. Air Intakes.

(a) Vent shafts shall be connected with a street, alley or court by a horizontal intake at a point below the lowest window opening on such shaft.

(b) Such intake shall have a minimum unobstructed cross-sectional area of not less than 3 square feet with a minimum dimension of 12 inches.

(c) The openings to the intake shall be not less than one foot above the bottom of the shaft and the street surface or bottom of court, at the respective ends of the duct or intake and shall be protected by substantial screens of corrosion resistant material having a mesh not larger than $\frac{3}{4}$ inch.

(d) Such intake shall be constructed of noncombustible, corrosion resistant material.

SECTION 504. VENTILATING SKYLIGHTS.

Skylights installed to meet the requirements of this article shall be glazed and protected as specified in section 805.4 and shall have glazed areas not less than required for the windows they replace. They shall be equipped with movable sashes or permanent

openings of an aggregate net area not less than required for openable parts in the windows they replace, or approved ventilation of equal effectiveness shall be provided.

SECTION 505. MECHANICAL VENTILATION.

When mechanical ventilation is required by this article or is permitted as an alternative, the system shall be designed and constructed in accordance with generally accepted good practice, to provide the necessary changes of air. Such systems shall be capable of supplying outside air at a rate of not less than 10 cubic feet per minute per occupant, based on number of occupants determined in accordance with section 601.2.

SECTION 506. COURTS.

506.1. Width.

(a) Outer courts required to serve habitable rooms shall have a width, at any level, of not less than 4 inches for each foot or fraction thereof of the height of such court, but not less than 5 feet.

(b) Inner courts required to serve habitable rooms shall have a width, at any level, of not less than one foot for each foot or fraction thereof of the height of such court, but not less than 10 feet.

(c) Courts required to serve other than habitable rooms shall have a width, at any level, of not less than 3 inches for each foot or fraction thereof of the height of such court, but not less than 5 feet.

506.2. Area.

(a) The cross-sectional area of a required inner court shall be not less than $1\frac{1}{2}$ times the square of its required width.

(b) The area of a required outer court shall be not greater than 4 times the square of its width.

506.3. Streets and alleys.

In case a street or alley is of less width than required for a court the building or that part dependent thereon shall be set back from such street or alley sufficiently to provide the required width, considering the street or alley as part of the court.

506.4. Intakes.

Every court serving one or more habitable rooms, that does not open for its full height on one or more sides on a street, alley or yard shall be connected at or near the bottom with a street, alley or yard by a horizontal intake or passage. Such intake or passage shall be constructed with walls, floors and ceilings having a fire resistance rating of not less than one hour, and shall have a cross-sectional area of not less than 21 square feet.

506.5. Unobstructed.

Every court shall remain unobstructed for its required width and full height, except that for outer courts, cornices and eaves projecting not more than 12 inches from a wall and for inner and outer courts ordinary window sills or belt courses, projecting not more than 4 inches from a wall, and drop awnings shall not be deemed obstructions. But this shall not prohibit in the open spaces at the ground level, in the case of buildings used for residential or institutional occupancies, clothes poles, arbors, garden trellises and other such accessories, and, in the case of dwellings only, permissible garages.

506.6. Drainage.

The bottom of every court shall be properly graded and drained.

506.7. Accessibility.

Every court that is not otherwise accessible at the bottom, shall be made accessible by a door or other means to enable it to be properly cleaned.

ARTICLE VI.

MEANS OF EGRESS.

SECTION 600. APPLICATION OF ARTICLE.

600.1. New buildings.

Buildings and structures, except dwellings, shall be provided with exit facilities in accordance with the requirements of this article.

600.2. Alterations.

No building or structure, including existing buildings and structures, shall be altered so as to reduce the number or capacity of exit ways to less than required in this article.

SECTION 601. GENERAL.

601.1. Exit way and exit doorway defined.

(a) Exit doorway means the doorway opening: directly to the exterior; to a horizontal exit; to an exit stairway; or to a similar place of safety.

(b) Exit way means the exit doorway or doorways, or such doorways together with connecting hallways or stairways, either interior or exterior, or fire escapes, by means of which occupants may proceed safely from a room or space to a street or to an open space which provides safe access to a street. Two or more separate exit ways may use the same corridor or hallway.

601.2. Number of occupants,

The number of occupants used in determining exit requirements shall be the number of occupants stated in the application for permit but in no case shall it be less than the number obtained by dividing the gross area per occupant as given in table 601 into the gross area of the building or structure or portion thereof considered; except that in areas where seating arrangements are used or contemplated, the number of occupants shall be not less than the number obtained by dividing 6 square feet per occupant into the net floor area used for seating.

For a high hazard occupancy the gross area per occupant shall be the figure in the table for the occupancy of a character similar to the high hazard occupancy.

88
x 90
100/2200
22 people

100 people / floor
100 / 10,000

TABLE 601

Occupancy	Gross Area Per Occupant
Dance hall, lodge room.....	15 Sq. Ft.
Mercantile—street floor and sales basement.....	30 Sq. Ft.
Other floors.....	60 Sq. Ft.
Garages	300 Sq. Ft.
Space used for occupancies not listed above:	
Assembly	40 Sq. Ft.
Business	100 Sq. Ft.
Educational	40 Sq. Ft.
Industrial	100 Sq. Ft.
Institutional	150 Sq. Ft.
Residential	125 Sq. Ft.
Storage	300 Sq. Ft.

SECTION 602. NUMBER OF EXIT WAYS AND DOORWAYS.

602.1. General.

Every story shall have at least one exit way and every story for 60 or more occupants in a building of fire-resistive construction or 45 or more occupants in a building of other than fire-resistive construction shall have not less than two separate exit ways.

602.2. Residential occupancy.

Every story used as a residential occupancy for 10 or more occupants shall have not less than two separate exit ways; except that a single exit way is permitted for multifamily houses of fire-resistive construction not exceeding two stories in height and containing not more than 12 dwelling units, or of heavy timber, noncombustible or ordinary construction not exceeding two stories in height and containing not more than 8 dwelling units.

602.3. Educational occupancy.

Every story used as an educational occupancy for 10 or more occupants shall have not less than two separate exit ways.

602.4. Institutional occupancy.

Every story used as an institutional occupancy for 4 or more occupants shall have not less than two separate exit ways. Every room or other space used as an institutional occupancy for 10 or more occupants shall have not less than two doorways complying with the provisions of section 609 for exit doorways and opening onto an exit way.

602.5. Basement and open air parking garages.

(a) Open air parking garages and sprinklered basement parking garages in which cars are personally parked shall be provided with at least one exit way from each parking level or floor but

shall be exempt from the requirement for additional exit ways in section 602.1; however this shall not be construed to exempt them from compliance with section 603 or other portions of this article.

(b) Open air parking garages in which cars are mechanically parked shall be provided with at least one exit way from each parking floor but shall be exempt from the requirement for additional exit ways in sections 602.1 and 603 and shall also be exempt from the requirement for enclosures in section 604.2; however this shall not be construed to exempt them from compliance with other portions of this article.

602.6. From rooms and other spaces.

(a) Every room, gallery, balcony, tier or other space having a capacity of 100 or more occupants shall have at least 2 doorways complying with the provisions of section 609 for exit doorways and opening onto an exit way.

(b) Every room, gallery, balcony, tier or other space having a capacity of more than 200 occupants shall have at least two exit ways, and where the capacity is more than 600 occupants at least 3 exit ways, and where the capacity is more than 1,000 occupants at least 4 exit ways. Such required exit ways may use communicating hallways or corridors, and exit ways from two or more portions of buildings may use common interior stairways, but the required exit ways for any one portion of a building shall not use a common interior stairway.

SECTION 603. LOCATION.

(a) Exit doorways shall be so located that the maximum distance from any point in a floor area, room or space to an exit doorway, measured along the line of travel, does not exceed:

75 feet for high hazard occupancies;

100 feet for educational, industrial, institutional, mercantile, residential and storage occupancies;

150 feet for assembly and business occupancies.

Where a floor area is subdivided into smaller areas such as rooms in hotels, multifamily houses and office buildings the distance to an exit doorway shall be measured from the corridor entrance of such rooms. Where the building is sprinklered, or is of fire-resistant construction or noncombustible construction occupied exclusively by stocks of noncombustible material not packed or crated in combustible material, the above distances to an exit doorway may be increased 50 per cent.

(b) In buildings permitted unlimited floor areas in section 402 and used by occupancies requiring undivided floor areas so large that the distances from points within the area to the nearest outside walls are in excess of those permitted by this section, and the basement or other floor area does not provide suitable exit ways,

exit doorways within the required maximum distances may be provided by:

- (1) Doorways opening to stairways leading down to tunnels under the floor extending to the outside of the building, provided such tunnels are adequately lighted and maintained to provide free and unobstructed egress at all times when the building is occupied; or
 - (2) Doorways opening to corridors or hallways enclosed by walls, floors and partitions of noncombustible material having a fire resistance rating of not less than 2 hours where such corridors or hallways lead directly to the exterior of the building.
- (c) Exit doorways and exit ways shall be located with proper regard to safety of the occupants and ease of egress. The size and shape of the room or space, the accessibility of streets and open spaces, the ability to use horizontal exits and the desirability of good separation of exit doorways shall be considered.

SECTION 604. INTERIOR STAIRWAYS.

604.1. Construction and arrangement of interior stairways.

(a) Interior stairways required by sections 602 and 603 shall be of noncombustible material in buildings of fire-resistive construction and in other buildings 4 stories or more in height.

(b) All stairways shall have solid treads and risers securely fastened in place.

(c) Treads and landings shall be adequately supported for their entire length and width and shall have a surface designed to limit the danger of slipping thereon.

(d) Every stairway required by sections 602 and 603 shall lead, either directly or through an exit hallway, to a street, or to an open space that communicates with a street.

(e) The continuity of all stairs which may be used for egress purposes, shall be interrupted at street level by partitions or doors, or other means shall be used, to indicate the main floor level and make clear the direction of egress to the street.

604.2. Enclosures.

(a) All interior stairways in buildings connecting two or more stories, whether required as exit stairways or not, shall be enclosed, except as otherwise provided in paragraph (d) of this section 604.2.

(b) Interior stairways in buildings 4 stories or more in height shall be enclosed with partitions of approved noncombustible material having a fire resistance rating of not less than 2 hours.

(c) In buildings less than 4 stories in height interior stairways shall be enclosed in partitions having a fire resistance rating of not less than one hour. In buildings of fire-resistive construction and noncombustible construction such partitions shall be of approved noncombustible material.

(d) An enclosure shall not be required for:

(1) A flight of stairs connecting only one floor with one other floor immediately above or below it where such stairs are not part of a required exit way and the stairway is effectively cut off at either floor by a partition having a fire resistance rating of not less than one hour.

(2) A stairway connecting 3 floors where such stairway is not part of a required exit way and the stairway is effectively cut off at the upper and lower floors by a partition having a fire resistance rating of not less than one hour.

(3) A flight of stairs from a mezzanine floor or balcony having an area not exceeding $33\frac{1}{3}$ per cent of the area of the floor immediately below provided there is not more than one mezzanine floor or balcony between complete floors above and below.

(e) **Openings.** No openings except the necessary doorways, and windows opening to the exterior of the building, shall be permitted in a stair enclosure required by this section. Such doorways shall be equipped with approved self-closing or automatic fire doors, except that when a two-hour fire resistance rating is not required for the enclosure, solid wooden doors of the flush type of nominal thickness not less than $1\frac{3}{4}$ inches may be used. In school buildings, doors on openings in stair enclosures may have wired glass panels.

604.3. Basement stairs.

Basement stairways located under stairways from upper stories shall be completely enclosed by construction with a fire resistance rating equal to the required enclosure above the basement.

604.4. Moving stairways.

(a) Moving stairways shall be equipped with an automatic stopping device which will stop the units simultaneously with the automatic detection of fire in the building. Such moving stairways may be considered as exit stairways, provided they are enclosed as required for interior stairways and conform with section 1302. Exit capacity shall be determined on the same basis as interior stairways. The minimum width of moving stairways considered as required exit stairways may be 2 inches less than specified in section 604.5(a), such width to be measured between the balustrading at a vertical height of 27 inches above the nose line of the treads. A width of 34 inches shall be counted as $1\frac{1}{2}$ units of stairway width and a width of 42 inches shall be counted as 2 units of stairway width.

(b) In sprinklered buildings floor openings for moving stairways not considered as required exit stairways need not be provided with enclosures as required for stairways if one of the following methods of protection is provided:

(1) The "sprinkler-vent" method which is an approved combination of an automatic fire or smoke detection system, automatic exhaust system and an automatic water curtain meeting the following requirements:

a. An exhaust system shall be so located and of such capacity as to create a downdraft through the moving stairway floor opening having an average velocity of not less than 300 feet per minute under normal conditions for a period of not less than 30 minutes. The operation of the exhaust system for any floor opening shall be initiated by an approved device in the story involved. There shall also be provided a manual means of operating and testing the system at periodic intervals.

b. A water curtain shall be formed by open sprinklers or spray nozzles so located and spaced as to form a complete and continuous barrier along all exposed sides of the floor opening and reaching from the ceiling to the floor. Water intensity for the water curtain shall be not less than 3 gallons per minute per lineal foot of water curtain measured horizontally around the opening. The water curtain shall operate automatically from a fixed temperature type device so placed with respect to the floor opening that the water curtain operates upon the advance of heat towards the moving stairway opening.

(2) The rolling shutter method which is an approved automatic self-closing rolling shutter which will completely enclose the top of each moving stairway, meeting the following requirements:

a. The shutter shall not be used to protect floor openings for moving stairways communicating directly with basements. Where used to protect floor openings the operation of the shutter shall be initiated by an automatic fire or smoke detection system located near the moving stairway. There shall be a manual means of operating and testing the operation of the shutter.

b. The shutter assembly shall be capable of supporting 200 pounds applied on any one square foot of area and shall be not less resistant to fire than 24 gauge steel. The shutter shall operate at a speed of not greater than 30 feet per minute and shall be equipped with a sensitive leading edge. The leading edge shall arrest the progress of the moving shutter and cause it to retract a distance of approximately 6 inches upon the application of a force not in excess of 20 pounds applied on the surface of the leading edge. The shutter, following retraction, shall continue to closure immediately.

(3) The spray nozzle method which is an approved combination of an automatic fire or smoke detection system and a system of high velocity water spray nozzles meeting the following requirements:

a. The number of spray nozzles, their discharge angles and their location shall be such that the moving stairway opening between the top of the wellway housing and the treadway will be completely filled with dense spray on operation of the system. Spray nozzles shall be of the open type and shall have a solid conical spray pattern with discharge angles between 45 and 90 degrees. The number and size of nozzles and water supply shall be sufficient to deliver a discharge of 2 gallons of water per square foot per minute through the wellway, area to be figured perpendicular to the slope of the moving stairway.

b. Spray nozzles shall be so located and positioned that the center line of spray discharge is as closely as possible in line with the slope of the moving stairway; at not more than an angle of 30 degrees with the top slope of the wellway housing. Nozzles shall be positioned, also, so that the center line of discharge is at an angle of not more than 30 degrees from the vertical sides of the wellway housing.

c. The spray nozzles shall discharge at a pressure of not less than 25 pounds per square inch. Water supply piping may be taken from the sprinkler system provided in so doing an adequate supply of water will be available for the spray nozzles and the water pressure at the sprinkler furthest from the supply riser is not reduced to a point below that required for the sprinklers. Control valves for the water supply to spray nozzles shall be so located as to be readily accessible.

d. The spray nozzle system shall operate automatically from thermal response elements of the fixed temperature type so placed with respect to the floor opening that the spray nozzle system operates upon the advance of heat towards the moving stairway opening. The system shall also be provided with manual means of operation.

e. A noncombustible draft curtain shall be provided extending at least 20 inches below and around the opening and a solid noncombustible wellway housing at least 5 feet long measured parallel to the handrail, and extending from the top of the handrail enclosure to the soffit of the stairway or ceiling above, at each moving stairway floor opening. Where necessary, spray nozzles shall be protected against mechanical injury.

(4) The kiosk method which consists of a noncombustible enclosure at the upper floor landings equipped with an approved double acting self-closing door or doors of metal and wired glass.

a. Wired glass in metal framework may be used for the enclosure provided no light of glass has a length or width greater than 48 inches.

b. The enclosure shall include a landing at each floor which is of sufficient length beyond the moving stairway to permit the full opening of the door or doors beyond the hand rail and having a width not less than that of the floor opening.

604.5. Width.

(a) The unobstructed width of a stairway serving in a required exit way for 45 or more occupants shall be not less than 44 inches. The unobstructed width of a stairway serving in a required exit way for less than 45 occupants shall be not less than 36 inches. Handrails attached to walls may project into the required width of a stairway not more than 3½ inches at each side.

(b) The unit of stairway width used as a measure of exit capacity shall be 22 inches. Fractions of a unit shall not be included except that an allowance of one-half unit may be made for 12 inches of stair width added to one or more 22-inch units of stair width.

(c) The aggregate width of exit stairways serving any story shall be based on the number of occupants of that story as determined by section 601.2, in accordance with the following table:

Occupancy	Number of Occupants Per Story Per Unit of	
	Exit Stairway Width	
Places of assembly on ground or street floor..	75	
Occupancies other than as listed above:		
Assembly	60	
Business	60	
Educational	60	
High hazard	30	
Industrial	60	
Institutional	30	
Mercantile	60	
Residential	30	
Storage	60	

The population of a mezzanine floor discharging through a floor below shall be added to the population of such floor.

(d) A stairway may be used as part of a required exit way from all floors which it serves.

604.6. Treads and risers.

(a) Treads and risers of required stairs shall be so proportioned that the product of the width of tread, exclusive of nosing, and the height of riser, in inches, shall be not less than 70 nor more than 75; but risers shall not exceed 7¾ inches in height, and treads, exclusive of nosing, shall be not less than 9 inches wide; except that in schools the proportion and dimensions of the treads and risers may, in the discretion of the building official, be adjusted to suit the age of the pupils for which the school is intended. Treads and risers shall be of uniform width and height in any one story.

- (b) The use of winders is prohibited in required stairways.

604.7. Landings.

(a) No flight of stairs shall have a vertical rise of more than 12 feet between floors or landings; except that in exit ways in buildings used for assembly occupancy such vertical rise shall not exceed 8 feet.

(b) The length and width of landings shall be not less than the width of stairways in which they occur.

604.8. Handrails.

(a) Except for steps in aisles, stairs shall have walls or well secured balustrades or guards on both sides.

(b) Such stairs when less than 44 inches in width shall have handrails on at least one side.

(c) Such stairs when required to be 44 inches or more in width shall have handrails on both sides.

(d) When the required width of a flight of stairs is 88 inches or more, intermediate handrails continuous between landings and securely supported shall be provided so that there will not be more than 66 inches between adjacent handrails.

604.9. Space under stairs.

The space under stairs built in whole or in part of combustible materials shall not be used for any purpose except as a means of egress.

SECTION 605. HORIZONTAL EXITS.

605.1. General.

Horizontal exits shall consist of vestibules, open air balconies, bridges, or doorways through or around fire walls or partitions of noncombustible material having a fire resistance rating of not less than 2 hours, connecting two floor areas. In buildings of other than fire-resistive construction, such partitions shall be continuous throughout all stories from the foundation to the roof.

605.2. Connecting floor areas.

The floor area on either side of a horizontal exit shall be sufficient to hold the occupants of both floor areas, allowing not less than 3 square feet of clear floor space per occupant.

605.3. Stairways.

On each side of a horizontal exit there shall be at least one interior stairway conforming to the requirements of this article, adequate for the number of occupants on that side of such horizontal exit served by the stairway.

605.4. Vestibules and balconies.

When open air vestibules or balconies are used in horizontal exits the floors shall be of noncombustible material and substantial railings at least 4 feet high without any openings greater than 8 inches in width shall be provided. Such balconies or vestibules shall adjoin either a street or court not less than 20 feet wide nor less than 1,000 square feet in area. Such court shall lead either directly or through an exit hallway to a street, or to an open space that communicates with a street. The balconies or vestibules shall be level with the floors of the building and the clear width of such balconies or vestibules shall be not less than required for hallways in section 608. Access from the building to vestibules or balconies shall be through doorways equipped with approved self-closing or automatic fire doors swinging in the direction of travel from the building to the vestibules or balconies.

605.5. Bridges.

When bridges are used in horizontal exits they shall be constructed of noncombustible material. The clear width of such bridges shall be not less than required in section 608 for hallways.

605.6. Openings.

All doorways or windows opening onto, under or within 10 feet of vestibules, balconies or bridges used in horizontal exits shall be equipped with self-closing fire doors or approved fire windows.

605.7. Gradients.

Where there is a difference in level between the connected floor areas, gradients of not more than 1 foot in 10 feet shall be provided. No stairs or steps shall be used in a horizontal exit.

SECTION 606. EXTERIOR STAIRWAYS.**606.1. General.**

Exterior stairways shall be constructed of noncombustible materials except on buildings of wood frame construction, and on buildings of ordinary construction not over 3 stories in height. Exterior stairways shall conform to the requirements for interior stairways in section 604, except that enclosures shall not be required and risers may be open for a height of one inch or less at the bottom.

606.2. Access.

Each story served by an exterior stairway shall have access to the stairway direct through an exit doorway.

606.3. Openings protected.

Except where wooden stairways are permitted, all doors and windows opening on or within 10 feet of exterior stairs or stairways

shall be protected by approved self-closing fire doors or approved fire windows.

606.4. Guards.

Unless otherwise enclosed, metal mesh or other rigid guards at least 4 feet high without any openings greater than 8 inches in width shall be provided throughout on each unenclosed side of exterior stairs or stairways.

606.5. Enclosures.

If exterior stairways other than wooden stairways are enclosed on any side, such enclosures shall be of noncombustible materials.

606.6. Glass.

Glass used in the construction of enclosures of exterior stairways shall be wired glass of approved type.

606.7. Strength.

Exterior stairways shall be of sufficient strength to sustain a live load of 100 pounds per square foot or concentrated loads of 300 pounds placed upon an area of $2\frac{1}{2}$ feet square so located as to produce maximum stress conditions.

606.8. Details.

All balcony floors and treads and risers of exterior stairs shall be solid except that perforations not exceeding $\frac{1}{2}$ inch in diameter may be used for purposes of drainage. All stairways shall be built permanently to the ground.

SECTION 607. RAMPS.

Ramps used in place of stairways shall be constructed and enclosed as required for the stairways displaced. Ramps used in exits ways shall have a slope not to exceed 1 foot in 10 feet and shall be provided with non-slip surfaces.

SECTION 608. HALLWAYS.

(a) The unobstructed width of a hallway or passageway in a required exit way and accommodating 45 or more occupants shall be not less than 36 inches. The unobstructed width of a hallway or passageway in a required exit way and accommodating less than 45 occupants shall be not less than 30 inches.

(b) The unit of width used as a measure of exit capacity for hallways or passageways in a required exit way shall be 22 inches. Fractions of a unit shall not be included except that an allowance of one-half unit may be made for 12 inches of hallway or passageway width added to one or more 22-inch units of such width. The

number of occupants that may be accommodated per unit of such width shall be in accordance with the following table:

Occupancy	Number of Occupants Per Unit of Hallway or Passageway Width
Places of assembly on ground or street floor..	100
Occupancies other than as listed above:	
Assembly	80 <i>do closed</i>
Business	80
Educational	80 <i>1 1/2 units</i>
High hazard.....	40
Industrial	80 <i>or 39"</i>
Institutional	40
Mercantile	80 <i>mem.</i>
Residential	40
Storage	80

(c) The hallway or corridor connecting a stairway with the exit doors leading to the street, or to a court or open space communicating with a street, shall have a clear width of not less than the required width of the stairway served thereby. Where two or more stairways discharge through a hallway or passageway the required width of the hallway or passageway shall be not less than the sum of three-quarters of the aggregate required widths of the stairways served thereby plus the width needed to serve required exit doors opening into the hallway or passageway.

(d) The enclosing walls, floors and ceilings of exit hallways connecting a required exit stairway to the doorway leading to the outside, shall have a fire resistance rating of not less than that required for the exit stairways which they serve and openings in the walls shall be protected by approved automatic or self-closing fire doors; except that in sprinklered buildings of fire-resistive construction the doorways and enclosing walls may have panels of wired glass in metal frames.

(e) Hallways above the first story shall not extend beyond an exit doorway as a dead end more than 50 feet.

SECTION 609. DOORWAYS.

609.1. Width.

(a) The minimum clear width of a door opening serving in a required exit way or leading to a required exit way shall be not less than 28 inches.

(b) The unit of width used as a measure of exit capacity for door openings shall be 22 inches. Fractions of a unit shall not be included except that an allowance of one-half unit may be made for 12 inches of door opening width added to one or more 22-inch units of such width. The number of occupants that may be accommo-

dated per unit of such width shall be in accordance with the following table:

Occupancy	Number of Occupants Per Unit of Door Opening Width
Places of assembly on ground or street floor..	100
Occupancies other than as listed above:	
Assembly	80
Business	80
Educational	80
High hazard.....	40
Industrial	80
Institutional	40
Mercantile	80
Residential	40
Storage	80

I need 34" on 2nd floor doors

Where a doorway is divided into two or more separate door openings, each such opening shall be measured separately in computing the number of units of exit width.

(c) Doorways on the street floor opening to the exterior of a building shall be provided with number of units of door opening width at least equal to:

- (1) Three-quarters of the number of required units of stair width from upper floors; plus
- (2) Three-quarters of the number of required units of stair width from floors below the street floor; plus
- (3) The number of units of door opening width required to serve the occupants on the street floor as determined in accordance with paragraphs (a) and (b) of this section 609.1.

Imports

609.2. Hanging of doors.

(a) The doors of doorways in a required exit way or leading to a required exit way shall be so hung and arranged that when fully opened they will not in any way diminish or obstruct the required width of hallway, stair, or other means of egress. Vertically sliding doors and rolling shutters shall not be used in a required exit doorway or doorway leading to a required exit way.

(b) Doorways opening on to an exit stairway, street or to a court or open space communicating with a street, and serving in a required exit way for 45 or more occupants shall have the doors, including the doors of vestibules, so hung as to swing open in the direction of exit travel.

(c) All doors in a required exit way or leading to a required exit way from rooms occupied by 45 or more persons and all doors in a required exit way or leading to a required exit way from places of assembly shall be hung to swing open in the direction of exit travel.

(d) No exit door shall open immediately on a flight of stairs, but a landing the length and width of which are not less than the width of such door, shall be provided between such door and such stairs.

609.3. Revolving doors.

(a) Revolving doors shall not be used in required exit ways from portions of buildings used as a place of assembly or for educational or institutional occupancies.

(b) Revolving doors used in required exit ways shall be placed between the first story above grade and the street or other open space which provides safe access to a street but in no case shall they be placed at the foot of stairs.

(c) Revolving doors used in required exit ways shall be an approved type, collapsible from pressure on the wings, and not less than 5 feet 6 inches in diameter.

(d) Revolving doors used in required exit ways shall not constitute more than 50 per cent of the required door width and each revolving door shall be counted as $\frac{1}{2}$ unit of exit door width.

(e) Where revolving doors constitute required exit doors the number of such doors shall not exceed the number of units of swinging door width within 20 feet.

609.4. Panic hardware.

Exit doorways opening directly to the exterior from places of assembly with a capacity in excess of 500 occupants, and the exterior exit doorways of school buildings housing in excess of 100 students, shall be equipped with approved panic release devices. Such devices shall operate when pressure of not more than 15 pounds is applied to the releasing devices in the direction of exit travel. These may include devices so arranged that operation of one door equipped with a panic release device releases the other door of a pair of doors.

SECTION 610. MAINTENANCE.

610.1. Physical condition.

All required exit ways shall at all times be maintained in good, safe, usable condition, and shall at all times be kept free and clear of obstructions and readily accessible.

610.2. Exit signs.

(a) In rooms accommodating more than 100 occupants required doorways, other than those normally used for entrance, shall be plainly marked by approved exit signs, sufficiently illuminated when the floor area is occupied, to be readily distinguished.

(b) Enclosed interior stairways and exterior stairways, which are provided in or for a building in addition to the required stair-

ways and which do not conform to the provisions of this article for required stairways, shall be marked in a suitable manner to indicate that they are not approved exit ways, but may be marked to indicate the extent to which they can be used as means of egress.

(c) When the exit doorways are not visible from all locations in public corridors, directional signs as required by the building official, shall be placed on walls or otherwise displayed in conspicuous locations to direct occupants to exit doorways.

610.3. Occupancy prohibited.

No part of a stairway, whether interior or exterior, nor of a hallway, corridor, vestibule, balcony, or bridge, serving in an exit way, shall be used for any purpose which will interfere with its value as an exit way.

610.4. Radiators.

No coil or radiator, or steam riser shall be placed in an exit stairway, nor in an aisle of a floor area in which seating accommodation is provided, unless the same be placed in a recess formed in or by the walls or partitions and guarded by a substantial metal screen for a height of not less than 6 feet.

ARTICLE VII.

REQUIREMENTS FOR TYPES OF CONSTRUCTION

SECTION 700. CLASSIFICATION OF CONSTRUCTION.

For the purposes of this code, construction as used in buildings and structures shall be classified as follows:

Fire-Resistive Construction—Type A. (Section 702)

Fire-Resistive Construction—Type B. (Section 703)

Protected Noncombustible Construction. (Section 704)

Unprotected Noncombustible Construction. (Section 705)

Heavy Timber Construction. (Section 706)

Ordinary Construction. (Section 707)

Wood Frame Construction. (Section 708)

SECTION 701. EXTENT OF COMPLIANCE REQUIRED.

Nothing in this code shall require a building or structure to comply with all of the provisions for a given type of construction when a less restrictive type of construction is permitted; but no building or structure shall be deemed of a given type of construction unless it conforms with all provisions of this code applying to that specific type.

SECTION 702. FIRE-RESISTIVE CONSTRUCTION—TYPE A.

702.1. General.

(a) All structural members including walls, columns, piers, beams, girders, trusses, floors and roofs shall be of approved noncombustible material.

(b) No pipes, wires, cables, ducts or other service equipment shall be embedded in the required fireproofing of any structural member, nor shall they be between the required fireproofing and the structural member protected; however, this shall not prohibit the installation of service equipment between fire resisting ceilings and the structural members protected thereby as covered by section 702.8.

702.2. Columns and piers.

(a) Columns and piers supporting loads from only one floor or roof shall have a fire resistance rating of not less than 3 hours. Columns and piers supporting loads from more than one floor or roof shall have a fire resistance rating of not less than 4 hours. All spaces between the required fireproofing and the member pro-

tected shall be firestopped with noncombustible material at each floor level.

(b) Where the fireproofing of columns is subject to damage from moving vehicles, handling of merchandise or other sources, the fireproofing shall be protected against such possible damage.

702.3. Floors.

Floors shall have a fire resistance rating of not less than 3 hours.

702.4. Roofs.

Roofs shall have a fire resistance rating of not less than 2 hours.

702.5. Beams, girders and trusses.

(a) Girders and trusses supporting loads from only one floor or roof shall have a fire resistance rating of not less than 3 hours. Girders and trusses supporting loads from more than one floor or roof shall be individually protected to have a fire resistance rating of not less than 4 hours.

(b) Beams, girders, and trusses supporting masonry or reinforced concrete walls shall be individually protected to have a fire resistance rating of not less than 4 hours.

702.6. Walls.

(a) Bearing portions of exterior and interior walls shall have a fire resistance rating of not less than 4 hours.

(b) Nonbearing portions of exterior and interior walls shall be of approved noncombustible material and:

(1) Where a horizontal separation of 3 feet or less is provided nonbearing portions of exterior walls shall have a fire resistance rating of not less than 3 hours and the total area of windows in such portions of an exterior wall shall not exceed 40 per cent of the total wall area;

(2) Where a horizontal separation of more than 3 feet but less than 20 feet is provided nonbearing portions of exterior walls shall have a fire resistance rating of not less than 2 hours and the total area of windows in such portions of an exterior wall shall not exceed 40 percent of the total wall area;

(3) Where a horizontal separation of 20 feet to 30 feet is provided nonbearing portions of exterior walls shall have a fire resistance rating of not less than one hour and the total area of windows in such portions of an exterior wall shall not exceed 60 per cent of the total wall area;

(4) Where a horizontal separation of 30 feet or more is provided no fire resistance rating is required for the nonbearing portions of exterior walls;

(5) Where there are 2 or more buildings on the same lot and the total area of the buildings does not exceed $1\frac{1}{2}$ times the allowable area of any one of the buildings no fire resistance rating is required for the nonbearing portions of exterior walls of these buildings that face each other;

(6) Openings in exterior walls shall be protected in accordance with section 803.1 and vertical separation between openings in exterior walls shall be provided in accordance with section 803.2.

(c) Lintels over openings in walls shall have a fire resistance rating not less than required by this section for the wall in which the lintel is placed; however, no fire resistance rating shall be required when the opening is spanned by a masonry arch designed to carry all imposed loads, or the opening is spanned by a beam above the lintel which has a fire resistance rating not less than required by this section for the wall in which the beam is placed, or the span does not exceed 4 feet. Stone lintels shall not be used unless supplemented with iron or steel lintels or masonry arches designed to support the imposed loads.

702.7. Partitions.

In buildings 4 stories or more in height interior partitions enclosing elevator shafts, stairways required by sections 602 and 603 and other openings through floors shall be of approved noncombustible material and shall have a fire resistance rating of not less than 2 hours. In buildings less than 4 stories in height partitions enclosing elevator shafts, stairways required by sections 602 and 603 and other openings through floors shall be of approved noncombustible material and shall have a fire resistance rating of not less than one hour. All other permanent partitions shall be of approved noncombustible material except that doors, door casings, frames, jambs and bucks, window and transom frames and casings may be of wood.

702.8. Fire resisting ceilings.

(a) Fire resisting ceilings shall be continuous except that one electrical outlet box not exceeding 16 square inches in area may be installed in such ceilings in each 90 square feet of ceiling area. Noncombustible pipes, ducts, additional or larger electrical outlets and other service equipment may be installed in fire resisting ceilings only when the type of ceiling to be used has been tested with such equipment installed in place and the proportionate area of openings for such equipment to be installed in the ceiling does not exceed the proportionate area of such openings in the assembly tested, and no opening is larger than that in the assembly tested.

(b) Duct openings installed in accordance with paragraph (a) above shall be protected by approved fire dampers.

(c) Nothing in this section shall be construed to prevent openings in fire resisting ceilings into shafts or ducts, the enclosing walls of which are of construction equivalent to the ceiling.

(d) The space above fire resisting ceilings shall be firestopped with approved noncombustible material to form areas of not more than 1,500 square feet. Steel not thinner than 24 gauge shall be accepted as firestopping.

702.9. Flooring, interior finish supports and trim.

(a) Where the floor finish is not laid directly on the floor slab the space between the floor finish and the slab shall be filled with noncombustible material in such a manner that there will be no open spaces under the floor finish which will exceed 100 square feet in area. Combustible boards not more than $\frac{1}{2}$ inch thick may be placed under the floor finish if laid directly on the floor slab or firestopped as required for the floor finish.

(b) Wooden trim used for door or window casings, chair rails, picture mouldings and baseboards shall be backed solidly with noncombustible material.

(c) Supporting members for wall or ceiling finish shall be of noncombustible material except for furring strips applied directly against a noncombustible surface.

SECTION 703. FIRE-RESISTIVE CONSTRUCTION—TYPE B.

703.1. General.

(a) All structural members including walls, columns, piers, beams, girders, trusses, floors and roofs shall be of approved noncombustible material.

(b) No pipes, wires, cables, ducts or other service equipment shall be embedded in the required fireproofing of any structural member, nor shall they be between the required fireproofing and the structural member protected; however, this shall not prohibit the installation of service equipment between fire resisting ceilings and the structural members protected thereby as covered by section 702.8.

703.2. Columns and piers.

(a) Columns and piers supporting loads from only one floor or roof shall have a fire resistance rating of not less than 2 hours. Columns and piers supporting loads from more than one floor or roof shall have a fire resistance rating of not less than 3 hours. All spaces between the required fireproofing and the member protected shall be firestopped with noncombustible material at each floor level.

(b) Where the fireproofing of columns is subject to damage from moving vehicles, handling of merchandise or other sources, the fireproofing shall be protected against such possible damage.

703.3. Floors.

Floors shall have a fire resistance rating of not less than 2 hours.

703.4. Roofs.

Roofs shall have a fire resistance rating of not less than 1½ hours.

703.5. Beams, girders and trusses.

(a) Girders and trusses supporting loads from only one floor or roof shall have a fire resistance rating of not less than 2 hours. Girders and trusses supporting loads from more than one floor or roof shall be individually protected to have a fire resistance rating of not less than 3 hours.

(b) Beams, girders and trusses supporting masonry or reinforced concrete walls shall be individually protected to have a fire resistance rating of not less than 3 hours.

703.6. Walls.

(a) Bearing portions of exterior and interior walls shall have a fire resistance rating of not less than 3 hours.

(b) Nonbearing portions of exterior and interior walls shall be of approved noncombustible material and:

(1) Where a horizontal separation of 3 feet or less is provided nonbearing portions of exterior walls shall have a fire resistance rating of not less than 3 hours and the total area of windows in such portions of an exterior wall shall not exceed 40 per cent of the total wall area;

(2) Where a horizontal separation of more than 3 feet but less than 20 feet is provided nonbearing portions of exterior walls shall have a fire resistance rating of not less than 2 hours and the total area of windows in such portions of an exterior wall shall not exceed 40 per cent of the total wall area;

(3) Where a horizontal separation of 20 feet to 30 feet is provided nonbearing portions of exterior walls shall have a fire resistance rating of not less than one hour and the total area of windows in such portions of an exterior wall shall not exceed 60 per cent of the total wall area;

(4) Where a horizontal separation of 30 feet or more is provided no fire resistance rating is required for the nonbearing portions of exterior walls;

(5) Where there are 2 or more buildings on the same lot and the total area of the buildings does not exceed 1½ times the allowable area of any one of the buildings no fire resistance rating is required for the nonbearing portions of the exterior walls of these buildings that face each other;

(6) Openings in exterior walls shall be protected in accordance with section 803.1 and vertical separation between openings in exterior walls shall be provided in accordance with section 803.2.

(c) Lintels over openings in walls shall have a fire resistance rating not less than required by this section for the wall in which the lintel is placed; however, no fire resistance rating shall be required when the opening is spanned by a masonry arch designed to carry all imposed loads, or the opening is spanned by a beam above the lintel which has a fire resistance rating not less than required by this section for the wall in which the beam is placed, or the span does not exceed 4 feet. Stone lintels shall not be used unless supplemented with iron or steel lintels or masonry arches designed to support the imposed loads.

703.7. Partitions.

In buildings 4 stories or more in height interior partitions enclosing elevator shafts, stairways required by sections 602 and 603 and other openings through floors shall be of approved non-combustible material and shall have a fire resistance rating of not less than 2 hours. In buildings less than 4 stories in height partitions enclosing elevator shafts, stairways required by sections 602 and 603 and other openings through floors shall be of approved non-combustible material and shall have a fire resistance rating of not less than one hour. All other permanent partitions shall be of approved noncombustible material or shall have a fire resistance rating of not less than one hour except that doors, door casings, frames, jambs and bucks, window and transom frames and casings may be of wood.

703.8. Fire resisting ceilings.

Fire resisting ceilings used to provide the required fire resistance ratings for structural members shall comply with section 702.8.

703.9. Flooring, interior finish supports and trim.

(a) Where the floor finish is not laid directly on the floor slab the space between the floor finish and the slab shall be filled with noncombustible material in such a manner that there will be no open spaces under the floor finish which will exceed 100 square feet in area. Combustible boards not more than $\frac{1}{2}$ -inch thick may be placed under the floor finish if laid directly on the floor slab or firestopped as required for the floor finish.

(b) Wooden trim used for door or window casings, chair rails, picture mouldings and baseboards shall be backed solidly with noncombustible material.

(c) Supporting members for wall or ceiling finish shall be of noncombustible material except for furring strips applied directly against a noncombustible surface.

SECTION 704. PROTECTED NONCOMBUSTIBLE CONSTRUCTION.

704.1. General.

(a) All structural members including walls, columns, piers, beams, girders, joists, trusses, floors and roofs shall be of approved noncombustible material.

(b) No pipes, wires, cables, ducts or other service equipment shall be embedded in the required fireproofing of any structural member, nor shall they be between the required fireproofing and the structural member protected; however, this shall not prohibit the installation of service equipment between fire resisting ceilings and the structural members protected thereby as covered by section 702.8.

704.2. Structural members.

Structural members including columns, piers, beams, girders, joists, trusses, floors and roofs shall have a fire resistance rating of not less than one hour. Beams, girders, joists, trusses, floors and roofs may be protected by a fire resisting ceiling complying with section 702.8.

704.3. Walls.

(a) Bearing portions of exterior and interior walls shall have a fire resistance rating of not less than 2 hours, except where a separation of 3 feet or less is provided bearing portions of exterior walls shall have a fire resistance rating of not less than 3 hours.

(b) Nonbearing portions of exterior walls shall be of approved noncombustible material and:

(1) Where a horizontal separation of 3 feet or less is provided nonbearing portions of exterior walls shall have a fire resistance rating of not less than 3 hours and the total area of windows in such portions of an exterior wall shall not exceed 40 per cent of the total wall area;

(2) Where a horizontal separation of more than 3 feet but less than 20 feet is provided nonbearing portions of exterior walls shall have a fire resistance rating of not less than 2 hours and the total area of windows in such portions of an exterior wall shall not exceed 40 per cent of the total wall area;

(3) Where a horizontal separation of 20 feet to 30 feet is provided nonbearing portions of exterior walls shall have a fire resistance rating of not less than one hour and the total area of windows in such portions of an exterior wall shall not exceed 60 per cent of the total wall area;

(4) Where a horizontal separation of 30 feet or more is provided no fire resistance rating is required for the nonbearing portions of exterior walls;

what about % Window

(5) Where there are 2 or more buildings on the same lot and the total area of the buildings does not exceed $1\frac{1}{2}$ times the allowable area of any one of the buildings no fire resistance rating is required for the nonbearing portions of the exterior walls of these buildings that face each other;

(6) Openings in exterior walls shall be protected in accordance with section 803.1 and vertical separation between openings in exterior walls shall be provided in accordance with section 803.2.7.

(c) Lintels over openings in walls shall have a fire resistance rating not less than required by this section for the wall in which the lintel is placed; however, no fire resistance rating shall be required when the opening is spanned by a masonry arch designed to carry all imposed loads, or the opening is spanned by a beam above the lintel which has a fire resistance rating not less than required by this section for the wall in which the beam is placed, or the span does not exceed 4 feet. Stone lintels shall not be used unless supplemented with iron or steel lintels or masonry arches designed to support the imposed loads.

(d) Exterior enclosure walls shall provide a durable and stable weatherproof exterior.

704.4. Partitions.

In buildings 4 stories or more in height interior partitions enclosing elevator shafts, stairways required by sections 602 and 603 and other openings through floors shall be of approved noncombustible material and shall have a fire resistance rating of not less than 2 hours. In buildings less than 4 stories in height partitions enclosing elevator shafts, stairways required by sections 602 and 603 and other openings through floors shall be of approved noncombustible material and shall have a fire resistance rating of not less than one hour. All other permanent partitions shall be of approved noncombustible material or shall have a fire resistance rating of not less than one hour. Doors, door casings, frames, jambs and bucks, window and transom frames and casings may be of wood in partitions other than those required to have a fire resistance rating of 2 hours or more.

SECTION 705. UNPROTECTED NONCOMBUSTIBLE CONSTRUCTION.

705.1. General.

All structural members including walls, partitions, columns, piers, beams, girders, joists, trusses, floors and roofs shall be of approved noncombustible material.

705.2. Exterior walls.

(a) Exterior walls shall be of approved noncombustible material and:

(1) Where a building exceeds 3,500 square feet in area and a horizontal separation of less than 20 feet is provided exterior walls shall have a fire resistance rating of not less than 2 hours and the total area of windows in such walls shall not exceed 40 per cent of the wall area;

(2) Where a building exceeds 3,500 square feet in area and a horizontal separation of 20 feet to 30 feet is provided exterior walls shall have a fire resistance rating of not less than one hour and the total area of windows in such walls shall not exceed 60 per cent of the wall area;

(3) Where the building is less than 3,500 square feet in area or a horizontal separation of 30 feet or more is provided no fire resistance rating is required for exterior walls;

(4) Where there are 2 or more buildings on the same lot and the total area of the buildings does not exceed $1\frac{1}{2}$ times the allowable area of any one of the buildings no fire resistance rating is required for the exterior walls of these buildings that face each other.

(b) Exterior enclosure walls shall provide a durable and stable weatherproof exterior.

705.3. Roofs.

Roofs of unsprinklered buildings exceeding 9,000 square feet in area shall not have a metal roof deck with any material applied directly to its upper surface which presents the hazard of propagation of fire on the under side of the metal roof deck.

705.4. Partitions.

Permanent partitions shall be of approved noncombustible material, and shall have a fire resistance rating of not less than one hour when enclosing elevator shafts, stairways required by sections 602 and 603 and other openings through floors. Doors, door casings, frames, jambs and bucks, window and transom frames and casings may be of wood.

SECTION 706. HEAVY TIMBER CONSTRUCTION.

706.1. Columns.

(a) Wooden columns shall be not less than 8 inches, nominal, in any dimension. All corners shall be rounded or chamfered.

(b) Columns shall be superimposed throughout all stories on each other, on reinforced concrete or metal post caps with brackets or be connected by properly designed steel or iron caps, pintels and base plates or by timber splice blocks affixed to the columns by means of devices or connectors housed within the contact faces.

(c) Columns of materials other than wood shall have a fire resistance rating of not less than one hour.

(d) Columns shall not rest on floor timbers; nor shall they rest on masonry foundations unless stone, cast iron or steel bases are used to transmit their loads.

706.2. Floors.

(a) Floors shall be without concealed spaces and shall be constructed of splined or tongued and grooved plank not less than 3 inches, nominal thickness, covered with 1-inch, nominal dimension, tongued and grooved flooring, laid crosswise or diagonally, or of laminated planks not less than 4 inches, nominal width, set on edge close together, spiked at intervals of 18 inches and covered with 1-inch, nominal dimension, flooring. In laminated floors the planks shall be laid with broken joints so that no continuous line will occur across the floor. Laminated floors shall not be spiked to the supporting girders. Joints of the planking shall be over supports or at the quarter points with no more than $2/3$ of the joints at such quarter points. Joints between planks shall be tight.

(b) Flooring shall not extend closer than $1/2$ inch to walls to provide an expansion joint. This joint shall be covered by a moulding fastened to the wall in such manner as not to obstruct an expansive movement of the floor; or the masonry may be corbeled under the floor planks to close this joint.

706.3. Roofs.

Roofs shall be without concealed spaces and roof decks shall be of matched or splined plank not less than 2 inches, nominal thickness, or of laminated planks not less than 3 inches, nominal width, set on edge close together and laid as required for floors. Other forms of roof decks may be used if of noncombustible materials.

706.4. Beams, girders, arches and trusses.

(a) Beams and girders of wood shall be not less than 6 inches, nominal, in least dimension nor less than 10 inches, nominal, in depth. Beams and girders supporting roof loads only shall be not less than 6 inches, nominal, in least dimension. If beams or girders are built up of 2 or more pieces they shall be securely glued or bolted laminated pieces and proper precaution shall be taken to prevent decay of contact faces.

(b) Timber arches or trusses may be used to support roof loads. The framing members shall be not less than 4-inch x 6-inch, nominal dimensions. Spaced members may be composed of 2 or more pieces not less than 3 inches, nominal, in thickness when blocked solidly throughout their intervening spaces or when such spaces are tightly closed by a continuous wood cover plate of not less than 2 inches, nominal thickness, secured to the underside of the members. Splice scabs shall be not less than 3 inches, nominal thickness. When protected by approved automatic sprinklers un-

der the roof deck, the framing members may be reduced to not less than 3 inches nominal thickness.

(c) Wall plates, boxes of self-releasing type or approved hangers shall be provided where beams or girders rest on walls. Where beams or girders enter masonry an air space of $\frac{1}{2}$ inch shall be provided at their sides, top and end, unless the wood is treated with an approved preservative.

(d) Where girders and beams meet columns they shall be fitted around pintles and round columns or butted up close to rectangular columns. The adjoining ends of girders and beams shall be cross tied by properly designed reinforced concrete, steel or iron post caps or metal straps lag screwed or bolted to their sides or shall be intertied to and with the columns by through-bolted corbel blocks, side bolsters, splice blocks and fillers so that the stresses are transferred by means of devices or metal connectors housed within the contacting faces of the members. Wood bolsters intertying adjoining girders or connecting roof trusses with columns may be used when supporting roof loads only.

(e) Where intermediate beams are used to support a floor, they shall rest on top of the girders or on side bolsters or blocks securely fastened to the girders by means of bolts and metal connectors; or they may be supported by approved steel or iron hangars into which the ends of beams shall be closely fitted. Interstices between beams framed together shall be filled in with a preservative compound.

(f) Beams, girders, arches and trusses of material other than wood shall have a fire resistance rating of not less than one hour.

(g) Wooden beams and girders supported by walls required to have a fire resistance rating of 2 hours or more shall have not less than 4 inches of solid masonry between their ends and the outside face of the wall, and between adjacent beams.

706.5. Walls.

(a) Bearing portions of exterior and interior walls shall be of approved noncombustible material, and shall have a fire resistance rating of not less than 2 hours except that where a horizontal separation of 3 feet or less is provided bearing portions of exterior walls shall have a fire resistance rating of not less than 3 hours.

(b) Nonbearing portions of exterior walls shall be of approved noncombustible material and:

(1) Where a horizontal separation of 3 feet or less is provided nonbearing portions of exterior walls shall have a fire resistance rating of not less than 3 hours and the total area of windows in such portions of an exterior wall shall not exceed 40 per cent of the total wall area;

(2) Where a horizontal separation of more than 3 feet but less than 20 feet is provided nonbearing portions of

exterior walls shall have a fire resistance rating of not less than 2 hours and the total area of windows in such portions of an exterior wall shall not exceed 40 per cent of the total wall area;

(3) Where a horizontal separation of 20 feet to 30 feet is provided nonbearing portions of exterior walls shall have a fire resistance rating of not less than one hour and the total area of windows in such portions of an exterior wall shall not exceed 60 per cent of the total wall area;

(4) Where a horizontal separation of 30 feet or more is provided no fire resistance rating is required for the nonbearing portions of exterior walls;

(5) Where there are 2 or more buildings on the same lot and the total area of the buildings does not exceed $1\frac{1}{2}$ times the allowable area of any one of the buildings no fire resistance rating is required for the nonbearing portions of the exterior walls of these buildings that face each other;

(6) Openings in exterior walls shall be protected in accordance with section 803.1 and vertical separation between openings in exterior walls shall be provided in accordance with section 803.2.

(c) Lintels over openings in walls shall have a fire resistance rating not less than required by this section for the wall in which the lintel is placed; however, no fire resistance rating shall be required when the opening is spanned by a masonry arch designed to carry all imposed loads, or the opening is spanned by a beam above the lintel which has a fire resistance rating not less than required by this section for the wall in which the beam is placed, or the span does not exceed 4 feet. Stone lintels shall not be used unless supplemented with iron or steel lintels or masonry arches designed to support the imposed loads.

706.6. Roof anchorage.

Every roof girder, and every alternate roof beam, shall be anchored to an exterior or interior wall or to a properly designed interior column; where supported by a wall roof planking shall be anchored to such wall at intervals not exceeding 20 feet; monitor and saw tooth construction shall be anchored to the main roof construction. Anchors shall consist of steel or iron bolts or straps of sufficient strength and ample anchorage to resist vertical uplift of the roof as required in section 903.

706.7. Partitions.

Interior partitions enclosing elevator shafts, stairways required by section 602 and 603 and other openings through floors in buildings 4 stories or more in height shall have a fire resistance rating of not less than 2 hours. Interior partitions enclosing openings

through floors in buildings less than 4 stories in height shall have a fire resistance rating of not less than one hour.

SECTION 707. ORDINARY CONSTRUCTION.

707.1. General.

Ordinary construction is that type of construction having exterior walls of noncombustible material having fire resistance ratings not less than specified in this section, and in which the other structural members including but not limited to columns, floors, roofs, beams, girders and joists are wholly or partly of wood of smaller dimensions than required for heavy timber construction, or of other combustible material.

707.2. Wooden columns.

(a) Wooden columns in the several stories of a building shall be set directly above one another, on top of the column below.

(b) The loads on wooden columns shall be transmitted to the columns below through reinforced concrete or metal caps with brackets, or through metal caps and bases with pintle connections or other properly designed column connections; provided that wooden bolsters may be used to support roof girders.

(c) Wooden columns shall not rest directly on floor joists.

(d) When supported by masonry, suitable stone or metal bases shall be set between the column and the masonry.

707.3. Beams, girders and joists.

(a) Wooden beams and joists, except headers and tail joists, and except for bearings complying with the allowable stresses provided in section 919.2, shall have bearings of at least 3 inches in length.

(b) Wooden trimmers, headers, and tail joists over 6 feet in length, unless supported on walls or girders, shall be hung in properly designed metal stirrups or hangers. If wood girders are set flush with the floor joists, the joists shall rest in properly designed metal stirrups or hangers. The ends of joists against the girders shall be securely nailed to the girders.

(c) Except in the case of pitched roofs, wooden floor and roof joists having spans in excess of 8 feet shall be rigidly braced with continuous rows of bridging at intervals not exceeding 8 feet.

(d) Joists shall be doubled under partitions which run over and parallel to the joists, or shall be designed for the load.

(e) The ends of wooden beams and joists resting on masonry shall be cut to a bevel of 3 inches in their depth.

(f) Wooden joists, beams and girders supported by walls required to have a fire resistance rating of 2 hours or more shall

have not less than 4 inches between their ends and the outside face of the wall, and between adjacent beams.

(g) When a wooden girder enters masonry an air space of $\frac{1}{2}$ inch shall be provided on the sides and end of such girder unless the wood is treated with an approved preservative, and each wall bearing end of a girder shall be cut on a bevel.

707.4. Anchorage.

(a) All trimmers and at least one beam or joist in every six feet resting on masonry walls, shall be secured to such walls by approved metal anchors attached at or near the bottom in a manner to be self-releasing. Each end of a trimmer, beam or joist that is supported by a girder, shall be secured or tied in an approved manner to such girder or to a trimmer, beam or joist correspondingly supported from the opposite side of such girder. Anchors and ties shall be so arranged as to form continuous ties between opposite masonry walls.

(b) Where floor or roof joists or beams run parallel to masonry walls such walls shall be secured to 4 or more joists of the floor or roof construction by approved metal anchors at maximum intervals of 8 feet for dwellings, and 6 feet in other buildings.

(c) Wall plates and roof construction shall be anchored to the walls at least every 6 feet.

(d) Wooden girders shall be anchored to the walls and fastened to each other with suitable steel straps placed near the bottom of the girder.

707.5. Walls.

(a) Bearing portions of exterior walls shall be of approved noncombustible material and shall have a fire resistance rating of not less than 2 hours except that where a horizontal separation of 3 feet or less is provided bearing portions of exterior walls shall have a fire resistance rating of not less than 3 hours.

(b) Nonbearing portions of exterior walls shall be of approved noncombustible material and:

(1) Where a horizontal separation of 3 feet or less is provided nonbearing portions of exterior walls shall have a fire resistance rating of not less than 3 hours and the total area of windows in such portions of an exterior wall shall not exceed 40 per cent of the total wall area;

(2) Where a horizontal separation of more than 3 feet but less than 20 feet is provided nonbearing portions of exterior walls shall have a fire resistance rating of not less than 2 hours and the total area of windows in such portions of an exterior wall shall not exceed 40 per cent of the total wall area;

(3) Where a horizontal separation of 20 feet to 30 feet is provided nonbearing portions of exterior walls shall have

a fire resistance rating of not less than one hour and the total area of windows in such portions of an exterior wall shall not exceed 60 per cent of the total wall area;

(4) Where a horizontal separation of 30 feet or more is provided no fire resistance rating is required for the non-bearing portions of exterior walls;

(5) Where there are 2 or more buildings on the same lot and the total area of the buildings does not exceed $1\frac{1}{2}$ times the allowable area of any one of the buildings no fire resistance rating is required for the nonbearing portions of the exterior walls of these buildings that face each other;

(6) Openings in exterior walls shall be protected in accordance with section 803.1 and vertical separation between openings in exterior walls shall be provided in accordance with section 803.2.

(c) Lintels over openings in walls shall have a fire resistance rating not less than required by this section for the wall in which the lintel is placed; however, no fire resistance rating shall be required when the opening is spanned by a masonry arch designed to carry all imposed loads, or the opening is spanned by a beam above the lintel which has a fire resistance rating not less than required by this section for the wall in which the beam is placed, or the span does not exceed 4 feet. Stone lintels shall not be used unless supplemented with iron or steel lintels or masonry arches designed to support the imposed loads.

707.6. Partitions.

(a) Interior partitions enclosing elevator shafts, stairways required by sections 602 and 603 and other openings through floors in buildings 4 stories or more in height shall have a fire resistance rating of not less than 2 hours. Interior partitions enclosing openings through floors in buildings other than dwellings and less than 4 stories in height shall have a fire resistance rating of not less than one hour.

(b) Load-bearing partitions shall be the equivalent of 2 x 4-inch studs, nominal dimensions, spaced not to exceed 16 inches on centers with the larger dimension perpendicular to the wall. All openings shall have studs doubled on each side and if more than 3 feet and 6 inches wide they shall be trussed over or shall have lintels of sufficient size to carry the load.

(c) Load-bearing stud partitions shall have top plates not smaller than double 2 x 4-inch, nominal dimensions, and unless the floor is designed for the load, shall be set over girders or other partitions below.

707.7. Firestopping.

(a) When the walls are furred, the space created by the furring shall be firestopped with noncombustible material at floors, ceilings and roofs. The firestopping shall be the full thickness of the furring and extend from the ceiling to the underside of the flooring or roof above.

(b) When joists run parallel to the wall the space between the wall and nearest joist shall be not less than 1 inch and shall be solidly filled with masonry or approved noncombustible material.

(c) Interior stud partitions shall be firestopped at the floors and ceiling of each story by a 2-inch nominal dimension, wood plate, the width of the stud, or the equivalent.

(d) When sliding doors are pocketed in partitions, such pockets shall be completely firestopped at the top, bottom and ends, with noncombustible material or with wood not less than 2 inches in thickness, nominal dimension.

(e) Except where a suspended ceiling is used the space between joists concealed between a ceiling and flooring or roof shall be firestopped for the full depth of the joists at the ends and over supports of the joists. Firestopping shall be with approved noncombustible material or with wood not less than 2 inches in thickness, nominal dimension.

(f) Where a suspended ceiling is used the space between the ceiling and flooring shall be sprinklered or shall be firestopped to form areas of not more than 1,000 square feet. Firestopping shall be of noncombustible material, ½-inch plywood with joints backed, wood not less than 2 inches in thickness, nominal dimension, or 2 thicknesses of 1-inch lumber with joints broken.

(g) Where a suspended ceiling is used the space between the ceiling and roof shall be sprinklered or shall be firestopped to form areas of not more than 3,000 square feet. Firestopping shall be of noncombustible material, ½-inch plywood with joints backed, wood not less than 2 inches in thickness, nominal dimension, or 2 thicknesses of 1-inch lumber with joints broken.

(h) Except in dwellings, all spaces between combustible wainscoting or paneling and the wall or partition to which it is attached shall be firestopped to form areas not exceeding 10 feet in any dimension.

(i) All horizontal or vertical openings through floors and ceilings, walls or partitions not specifically mentioned above such as spaces around pipes, conduits and ducts shall be firestopped.

(j) No firestopping shall be covered or concealed until inspected by the building official.

707.8. Bay windows and show windows.

Show windows that do not extend above the second story floor level and bay windows on dwellings may be constructed of wood.

When such bay windows of wood are more than 10 feet in width they shall be covered on the exterior surfaces with metal or other approved noncombustible, weatherproof materials.

707.9. Mansard roofs.

Mansard or other slanting roofs having pitch of more than 60° from the horizontal, placed on a building over 40 feet in height, shall be of fire-resistive construction.

707.10. Draft stops in attic spaces.

Attic spaces shall be sprinklered or shall be divided into areas of 3,000 square feet or less by tight draft stops; these shall be of ½-inch plywood with joints backed, or 2 thicknesses of 1-inch lumber with joints broken or the equivalent, with self-closing access doors of similar construction.

SECTION 708. WOOD FRAME CONSTRUCTION.

708.1. General.

Wood frame construction is that type of construction in which the structural members are wholly or partly of wood or other combustible material and the construction does not qualify as heavy timber construction or ordinary construction.

708.2. Wooden columns.

(a) Wooden columns in the several stories of a building shall be set directly above one another, on top of the column below.

(b) The loads on wooden columns shall be transmitted to the columns below through reinforced concrete or metal caps with brackets, or through metal caps and bases with pintle connections or other properly designed column connections; provided that wooden bolsters may be used to support roof girders.

(c) Wooden columns shall not rest directly on floor joists.

(d) When supported by masonry, suitable stone or metal bases shall be set between the column and the masonry.

708.3. Beams, girders and joists.

(a) Wooden beams and joists, except headers and tail joists, and except for bearings complying with the allowable stresses provided in section 919.2 shall have bearings of at least 3 inches in length.

(b) Wooden trimmers, headers, and tail joists over 6 feet in length, unless supported on walls or girders, shall be hung in properly designed metal stirrups or hangers. If wood girders are set flush with the floor joists, the joists shall rest in properly designed metal stirrups or hangers. The ends of the joists against the girders shall be securely nailed to the girders.

(c) Except in the case of pitched roofs, wooden floor and roof joists having spans in excess of 8 feet shall be rigidly braced with continuous rows of bridging at intervals not exceeding 8 feet.

(d) Joists shall be doubled under partitions which run over and parallel to the joists, or shall be designed for the load.

(e) Each end of a trimmer, beam or joist that is supported by a girder, shall be secured or tied in an approved manner to such girder or to a trimmer, beam or joist correspondingly supported from the opposite side of such girder.

(f) Wooden joists, beams and girders supported by walls required to have a fire resistance rating of 2 hours shall have not less than 4 inches between their ends and the outside face of the wall, and between adjacent beams.

(g) Where ledger or ribbon boards are used to support joists, such boards shall be not less than 1 x 4 inch, nominal dimensions, shall be cut into the studs and securely nailed to each stud, and the joists shall be spiked to the studs.

708.4. Anchorage.

(a) Sills shall be anchored to the foundation walls at intervals not exceeding 6 feet by anchors equivalent to bolts not less than $\frac{1}{2}$ inch in diameter with proper washers, embedded at least 6 inches in the foundation.

(b) In all buildings 20 feet or more in width where joists run at right angles to the rafters, the rafters shall be tied to the ceiling joists with wood or metal ties nailed to the foot of alternate rafters and extending across 4 joists well nailed to each joist.

(c) All joists shall be well lapped and nailed across the building to form ties between outside walls.

708.5. Exterior walls.

(a) Exterior walls shall be constructed to develop a strength and rigidity equivalent to wooden studding, not less than 2 by 4 inches, nominal dimensions, spaced 16 inches on centers with the larger dimension perpendicular to the wall, and braced with approved $\frac{5}{8}$ inch thick wood sheathing applied diagonally or with diagonal bracing at the corners or with other approved materials or methods to secure the necessary rigidity; except in one-story buildings studs not over 10 feet in length may be spaced not to exceed 24 inches on centers. Materials and methods of construction, whether prefabricated or otherwise, meeting the structural requirements of nationally recognized good practice shall be deemed to have the necessary strength and rigidity.

(b) The exterior walls shall have fire resistance ratings as follows:

(1) Where a building exceeds 2,500 square feet in area and a horizontal separation of less than 20 feet is provided exterior walls shall have a fire resistance rating of not less than 2 hours and the total area of windows in such walls shall not exceed 40 per cent of the wall area;

(2) Where a building exceeds 2,500 square feet in area and a horizontal separation of 20 feet to 30 feet is provided exterior walls shall have a fire resistance rating of not less than one hour and the total area of windows in such walls shall not exceed 60 per cent of the wall area;

(3) Where the building is less than 2,500 square feet in area or a horizontal separation of 30 feet or more is provided no fire resistance rating is required for exterior walls;

(4) Where there are 2 or more buildings on the same lot and the total area of the buildings does not exceed $1\frac{1}{2}$ times the allowable area of any one of the buildings, no fire resistance rating is required for the exterior walls of these buildings that face each other.

708.6. Partitions.

(a) Except in dwellings, interior partitions enclosing openings through floors shall have a fire resistance rating of not less than one hour.

(b) Load-bearing partitions shall be the equivalent of 2 x 4-inch studs, nominal dimensions, spaced not to exceed 16 inches on centers with the larger dimension perpendicular to the wall. All openings shall have studs doubled on each side and if more than 3 feet and 6 inches wide they shall be trussed over or shall have lintels of sufficient size to carry the load.

(c) Load-bearing stud partitions shall have top plates not smaller than double 2 x 4 inch, nominal dimensions, and unless the floor is designed for the load, shall be set over girders or other partitions below.

708.7. Firestopping.

(a) Exterior walls of wood frame construction shall be properly firestopped at each floor level, at the top story ceiling level, at the roof level in the case of flat roofs, and at the foot of rafters in the case of sloping roofs, with noncombustible material or with wood not less than 2 inches in thickness, nominal dimension.

(b) Except where a suspended ceiling is used the space between joists concealed between a ceiling and flooring or roof shall be firestopped for the full depth of the joists at the ends and over supports of the joists. Firestopping shall be with approved noncombustible material or with wood not less than 2 inches in thickness, nominal dimension.

(c) Where a suspended ceiling is used the space between the ceiling and flooring shall be sprinklered or shall be firestopped to form areas of not more than 1,000 square feet. Firestopping shall be of noncombustible material, $\frac{1}{2}$ -inch plywood with joints backed, wood not less than 2 inches in thickness, nominal dimension, or 2 thicknesses of 1-inch lumber with joints broken.

(d) Where a suspended ceiling is used the space between the ceiling and roof shall be sprinklered or shall be firestopped to

form areas of not more than 3,000 square feet. Firestopping shall be of noncombustible material, $\frac{1}{2}$ -inch plywood with joints backed, wood not less than 2 inches in thickness, nominal dimension, or 2 thicknesses of 1-inch lumber with joints broken.

(e) Interior stud partitions shall be firestopped at the floor and ceiling of each story by a 2-inch, nominal dimension, wood plate, the width of the stud, or the equivalent.

(f) When sliding doors are pocketed in partitions, such pockets shall be completely firestopped at the top, bottom and ends with noncombustible material or with wood not less than 2 inches in thickness, nominal dimension.

(g) Except in dwellings, all spaces between combustible wainscoting or paneling and the wall or partition to which it is attached shall be firestopped to form areas not exceeding 10 feet in any dimension.

(h) All horizontal or vertical openings through floors and ceilings, walls or partitions not specifically mentioned above, such as spaces around pipes, conduits and ducts shall be firestopped.

(i) No firestopping shall be covered or concealed until inspected by the building official.

708.8. Draft stops in attic spaces.

Attic spaces shall be sprinklered or shall be divided into areas of 3,000 square feet or less by tight draft stops; these shall be of $\frac{1}{2}$ -inch plywood with joints backed, or 2 thicknesses of 1-inch lumber with joints broken or the equivalent, with self-closing access doors of similar construction.

ARTICLE VIII.

FIRE PROTECTION REQUIREMENTS.

SECTION 800. FIRE WALLS.

800.1. Where fire walls are required.

(a) Fire walls shall be so located in buildings that the floor area between exterior walls or between exterior walls and fire walls does not exceed the floor area limits of table 402 and section 402.3.

(b) Fire walls shall be so located that the aggregate floor area between exterior walls or between exterior walls and fire walls of adjoining buildings utilizing walls adapted for joint service between 2 buildings does not exceed the floor area limits of table 402 and section 402.3.

800.2. Construction.

(a) Fire walls shall be of noncombustible material having a fire resistance rating of not less than 4 hours, and have sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.

(b) Walls constructed of solid masonry or of hollow masonry units or of reinforced concrete shall be considered as meeting the above requirement for structural stability under fire conditions when conforming to this section 800 and, except as otherwise specifically provided in this section, also conforming to sections 909 and 913.

(c) Fire walls shall start at the foundation and extend continuously through all stories to and above the roof, except where the roof is of fire-resistive construction and the wall is carried up tightly against the under side of the roof slab.

(d) Where structural members project into hollow masonry units, the hollow space shall be filled with noncombustible material the full thickness of the wall and 6 inches or more above, between and below such members.

800.3. Thickness of solid masonry walls except panel walls.

(a) Fire walls of solid masonry shall be not less than 12 inches thick for the uppermost 35 feet of their height, and shall be increased 4 inches in thickness for each successive 35 feet or fraction thereof measured downward from the top of the wall.

(b) Where solid masonry fire walls are stiffened at distances not greater than 12 feet apart by masonry cross walls or by reinforced concrete floors or roof, they may be 12 inches thick for the uppermost 70 feet, measured downward from the top of

the wall, and shall be increased 4 inches in thickness for each successive 70 feet or fraction thereof.

800.4. Thickness of hollow masonry walls except panel walls.

Fire walls of hollow masonry units including brick-faced hollow masonry walls shall have a total thickness of not less than 4 inches greater than required in section 800.3 for solid masonry walls.

800.5. Thickness of reinforced concrete walls except panel walls.

Fire walls of reinforced concrete shall have a thickness of not less than $1/25$ of the unsupported height or width, whichever is the shorter, but in no case shall it be less than 9 inches thick for the uppermost 35 feet and increase 2 inches in thickness for each successive 35 feet or fraction thereof measured downward from the top of the wall.

800.6. Exception to thickness requirements for panel walls.

Where fire walls are constructed as panel walls in a framework of columns and girders having fire resistance ratings of not less than 4 hours and no panel exceeds 40 feet in length nor 12 feet in height between supports, they may be 12 inches thick if constructed of hollow masonry units or 8 inches thick if constructed of solid masonry or reinforced concrete.

800.7. Parapet requirements.

Parapets shall be provided on fire walls in accordance with section 801.

800.8. Size and protection of openings.

(a) In unsprinklered buildings no opening in a fire wall shall exceed 120 square feet in area with no dimension greater than 12 feet, and the aggregate width of all openings at any level shall not exceed 25 per cent of the length of the wall; except that in sprinklered buildings the size and aggregate width of openings in a fire wall are not limited.

(b) Every opening in a fire wall required by section 800.1 shall be protected on each side of the wall with an approved automatic or self-closing fire door; except that when a fire wall serves also as a horizontal exit way it shall have no openings other than door openings not exceeding 48 square feet in area, and one of the fire doors at each opening shall be a self-closing fire door.

SECTION 801. PARAPETS.

(a) Except as listed below, parapets shall be provided on all fire walls and exterior walls required to have a fire resistance rating of 2 hours or more. Parapets are not required on;

- (1) Exterior walls and fire walls connecting with roofs of fire-resistive construction;
 - (2) An exterior wall of a building the roof of which is at least 3 feet lower than the roof of, or any opening in, an adjacent building wall;
 - (3) Exterior walls facing on a street having a width of 30 feet or more;
 - (4) Exterior walls of a building which is 30 feet or more distant in all directions from the nearest line to which other buildings are or may be legally built and from other buildings on the same lot;
 - (5) Exterior walls of a building which is 30 feet or more distant in all directions from the nearest line to which other buildings are or may be legally built but less than 30 feet distant to one or more buildings on the same lot, where the total area of the buildings within 30 feet of each other does not exceed $1\frac{1}{2}$ times the allowable area for any one of the buildings considered;
 - (6) Exterior walls of a detached dwelling, or of a building not exceeding 1,000 square feet in area;
 - (7) Exterior walls of a building where the roof has an angle of more than 20 degrees with the horizontal.
- (b) Parapets shall have fire resistance ratings not less than required for the exterior wall or fire wall on which it is provided.
- (c) Parapets on exterior walls required to have a fire resistance rating of 2 hours shall extend not less than 2 feet above the roof; parapets on exterior walls required to have a fire resistance rating of 3 or 4 hours shall extend not less than 3 feet above the roof; parapets on fire walls shall extend at least to the same height as any part of the roof through which the fire wall passes within 15 feet of the parapet and in no case shall it extend less than 3 feet above the point where the parapet and roof intersect.
- (d) Masonry and reinforced concrete parapets shall be at least as thick as the required thickness of the wall on which it is provided but need not be more than 12 inches thick on exterior walls.
- (e) Parapets shall be properly coped and flashed with non-combustible, weatherproof material. All corners of masonry parapet walls shall be reinforced with at least one $\frac{1}{4}$ -inch bar in every third joint, continuous around the corner and extending into the masonry at least 3 feet from the corner.

SECTION 802. ROOF COVERING.

802.1. Classification.

Roof coverings shall be classified in accordance with nationally recognized good practice as follows:

- (1) Class A roof coverings are those which are effective against severe fire exposures and possess no flying brand hazard;
- (2) Class B roof coverings are those which are effective against moderate fire exposures and possess no flying brand hazard;
- (3) Class C roof coverings are those which are effective against light fire exposures and possess no flying brand hazard.

802.2. Roof covering required.

Every roof placed on a building or structure shall be covered with Class A or Class B roof coverings except that Class C roof coverings shall be accepted on:

- (1) Dwellings;
- (2) Buildings of wood frame construction;
- (3) Buildings located outside of the fire limits which on the basis of height and area could be of wood frame construction under this code.

802.3. Installation.

(a) The roof covering shall be applied in compliance with the manufacturers' instructions to a solid or closely fitted deck or directly to the building frame work.

(b) The use of cork, fiber board or other approved insulation is permitted on top of the roof deck provided such insulation is covered with a roof covering complying with this section and applied directly thereto.

SECTION 803. PROTECTION OF OPENINGS IN EXTERIOR WALLS.


803.1. Protection required.

Except as listed below every opening in an exterior wall of a building shall be protected by an approved fire window, fire door or other approved protective when such opening:

- (1) Faces on a street and is less than 30 feet from the opposite building line;
- (2) Is less than 30 feet distant in a direct unobstructed line from an opening in another building or from a wood frame building;
- (3) Is above and less than 30 feet from any part of a neighboring roof of combustible materials or any roof having openings within this distance;
- (4) Faces on and is located less than 15 feet from an adjacent lot line;

- (5) Is within 10 feet of an exterior stairway required to be of noncombustible materials in section 606.1;
 - (6) Opens onto, under or is within 10 feet of vestibules, balconies or bridges used in connection with exit ways.
- Openings in exterior walls are not required to be protected in:
- (1) Dwellings;
 - (2) Churches;
 - (3) Buildings of wood frame construction;
 - (4) Buildings of unprotected noncombustible construction;
 - (5) Open air parking garages built in accordance with section 316.1.

803.2. Vertical separation between openings in exterior walls.



Except as listed below the exterior openings located vertically above one another shall have not less than 3 feet vertical separation provided by an assembly of noncombustible material having a fire resistance rating of not less than 2 hours between the top of one opening and the bottom of the one next above, or the exterior openings shall be separated by such an assembly extending outwardly from the building wall a horizontal distance of not less than 3 feet. No vertical separation is required between exterior openings when:

- (1) The building is of ordinary construction and is located outside of the fire limits; or;
- (2) The building is of unprotected noncombustible construction or wood frame construction; or
- (3) The lower of any 2 successive exterior openings under consideration opens onto a room or space used for assembly, business, educational, institutional or residential occupancy; or
- (4) The higher of any 2 successive exterior openings under consideration is setback from the lower exterior opening a horizontal distance of not less than 3 feet; or
- (5) The exterior openings are protected by automatic closing fire windows or doors or fire windows with fixed sash.

803.3. Fire shutters.

When equipped with fire shutters, at least one in every 3 openings facing a street in each story shall have such shutters arranged to be readily opened from the outside. Distinguishing marks shall be provided on these shutters

803.4. Openings to exit ways.

When fire doors or fire shutters are used on openings to exit ways or fire escapes they shall be so arranged as not to obstruct such exit ways or fire escapes.

803.5. Glazing.

For the glazing of fire doors, when permitted, or of fire windows, only wired glass shall be used which shall be not less than $\frac{1}{4}$ -inch thick.

SECTION 804. SHAFTS.**804.1. General.**

The provisions of this section shall apply to all shafts used for ventilation, light, elevators, dumbwaiters, pipes, or other purpose, except stairways, air ducts, incinerator chutes, flues, shafts in dwellings, and ramps in garages exempted by sections 316.1(f), 316.3(d) and 316.4(e).

804.2. Shaft enclosures.

(a) The enclosing walls of shafts extending through less than 4 stories of a building shall have a fire resistance rating of not less than one hour. Such enclosing walls shall be of approved noncombustible material in buildings of fire-resistive construction.

(b) The enclosing walls of shafts extending through 4 stories or more of a building shall be of approved noncombustible material having a fire resistance rating of not less than 2 hours.

804.3. Openings.

Shaft enclosures shall have no openings other than the necessary doorways, and windows opening to the exterior of the building; provided that in elevator shafts there shall be at least one door at every third floor but not more than 36 feet apart. Doorways shall be equipped with approved self-closing or automatic fire doors except that when a 2 hour fire resistance rating is not required for the enclosure, solid wood doors of the flush type of nominal thickness not less than $1\frac{3}{4}$ inches may be used.

804.4. Enclosure at top.

(a) Shaft enclosures which extend to or through the roof of a building shall be provided with a skylight of at least 10 per cent of the area within the enclosing walls of the shaft in the top story and glazed with plain glass or other noncombustible material which may be easily pierced by fire-fighting personnel. If glass is used it shall be plain glass not more than $\frac{1}{8}$ -inch in thickness. The skylight may be replaced by a window of similar glazing of equivalent area in the side of the shaft if the sill of such window is not less than 2 feet above the roof and the window does not face a lot line within 10 feet, or may be replaced by approved means of ventilation.

(b) A shaft that does not extend into the top story of a building shall have the top enclosed with a form of construction equal to that required for the enclosing walls of the shaft.

804.5. Enclosure at bottom.

A shaft that does not extend to the bottom of the building shall be enclosed at its lowest point with a floor construction of the same type as that required for the lowest floor to or through which it passes, but such shaft floor construction shall have a fire resistance rating of not less than one hour.

804.6. Elevator machinery compartment.

Compartments containing machinery for operating elevators shall be separated from other portions of the building except the shaft by noncombustible material having a fire resistance rating not less than required for the enclosing walls of the shaft, with door openings equipped with approved fire doors.

804.7. Number of elevators in shaft.

Not more than 4 elevators shall be placed in one shaft.

SECTION 805. PENT HOUSES AND ROOF STRUCTURES.**805.1. General.**

Except for flag poles and water tanks, and for supports of radio and television antennas less than 12 feet in height, all construction placed on the roof of a building within the fire limits or over the roof of a building more than 55 feet in height wherever located shall be of noncombustible material except as otherwise provided in section 805.6 for towers for water tanks and in section 805.7 for cooling towers. All equipment installed on roofs shall be substantially constructed and securely fastened to withstand all loads to which it may be subjected including wind loads specified in section 903.

805.2. Roof structures.

The walls of roof structures erected on buildings of fire-resistive construction and protected noncombustible construction shall be constructed as required for exterior non-bearing walls of the type of construction of the building upon which the roof structure is located. The roofs of such roof structures shall have a fire resistance rating of not less than required for the main roof of the building. The walls and roofs of roof structures on other types of buildings, unless constructed of masonry or reinforced concrete, shall be covered on the outside with noncombustible weatherproof material.

805.3. Pent houses.

(a) A pent house having an area exceeding $33\frac{1}{3}$ per cent of the roof area or 1,000 square feet shall be considered a story of the building.

(b) The exterior walls of a pent house shall be constructed as required for exterior non-bearing walls of the type of construction of the building upon which the pent house is located.

805.4. Skylights.

(a) Skylights placed over shafts, vent shafts, stair enclosures, and exit ways required by sections 602 and 603, shall be glazed with glass or other noncombustible material which may be easily pierced by fire-fighting personnel. If glass is used it shall be plain glass not more than $\frac{1}{8}$ -inch thick.

(b) Skylights other than as specified above, which are inclined less than 60° from the horizontal, shall have the sashes and frames thereof constructed of approved noncombustible material and glazed with wired glass, approved glass blocks or an approved plastic which does not present a fragmentation hazard; skylights in foundries or buildings where acid fumes are present may have sashes and frames of wood by special permission of the building official. Such skylights shall also comply with paragraphs (c) and (d) of this section 805.4.

(c) Every skylight in which plain glass is used shall be protected by a substantial wire screen with wire not lighter than number 12 gauge and having a mesh not less than $\frac{3}{4}$ of an inch nor larger than 1 inch, placed not less than 4 inches or more than 10 inches above the glazed portion of the skylight at all points. Such screen shall extend beyond the glazing on all sides a distance not less than the height of the screen above the glazing. When a skylight is located over a stairway, public hallway or a place of assembly, a similar screen shall also be placed below the skylight, unless there is an intermediate ceiling light.

(d) Skylights in which combustible plastic is used shall be constructed in accordance with the following provisions:

(1) The skylight shall have a curb which is not less than 4 inches in height above the adjoining roof surface.

(2) The area within the curbs of each skylight shall not exceed 100 square feet. The aggregate area of skylights shall not exceed 20 per cent of the floor area sheltered by the roof upon or in which they are installed.

(3) There shall be a distance of not less than 5 feet between skylights and not less than 20 feet between the skylights and any wall in which the exterior openings are required to be protected by section 803.

(4) Skylights shall be protected by a substantial wire screen placed above the glazing as provided in this section for glass unless they are constructed and installed in such a manner that flying brands will not be likely to lodge on the plastic.

805.5. Dormer windows.

Dormer windows shall be of the same type of construction as the roof on which they are placed or the side walls of the building. The top shall be covered with materials prescribed for roof covering in section 802.

805.6. Water tanks.

(a) Water tanks of more than 500 gallons capacity placed on or in a building shall be supported on masonry, reinforced concrete or steel construction except that portion of the supporting structure which is above the roof of the building may be of heavy timbers; provided that when such supporting construction is within the building it shall be protected as required for fire-resistive—type A construction.

(b) Such tanks shall not be placed over a stairwell or elevator shaft.

(c) All unenclosed roof tanks shall have covers sloping toward the outer edges.

(d) When hoops are used in the construction of tanks they shall be of metal, round in cross section and provision shall be made to guard against corrosion.

805.7. Cooling towers.

Cooling towers in excess of 250 square feet base area when located inside the fire limits, and when located on buildings 55 feet or more in height outside the fire limits, shall be constructed of noncombustible material except that drip bars may be of wood.

805.8. Roof ponds.

When roofs are used for ponds for water cooling for air conditioning or insulation the roof supports shall be designed for the imposed load and the roofing and flashing shall be in conformity with the use, and ample drainage outlets shall be provided for the discharge of the water.

SECTION 806. BASEMENTS.**806.1. Partitions.**

Except in dwellings and buildings of wood frame construction, partitions in basements shall be constructed of noncombustible material or shall have a fire resistance rating of not less than one hour, unless such partitions enclose only coal or wood bins, or unless the basement is sprinklered.

806.2. Ceilings.

Except in one-story buildings outside the fire limits and in dwellings, the ceilings over basements shall be fire retardant ceilings unless the basement is sprinklered.

806.3. Fire department access.

Except in dwellings, basements shall be provided with a stairway, window or hoistway opening connected direct to the outside air so located and of such size as to permit its use by firemen at the time of fire; provided that such provision need not be made where the basement is sprinklered.

SECTION 807. FRAMING AROUND CHIMNEYS AND FIREPLACES.

(a) All wood beams, joists and studs shall be trimmed away from chimneys and fireplaces. Headers, beams, joists and studs shall be not less than 2 inches from the outside face of a chimney or from masonry enclosing a flue. Headers supporting trimmer arches at fireplaces shall be not less than 20 inches from the face of the chimney breast. Trimmers shall be not less than 6 inches from the inside face of the nearest flue lining.

(b) A clearance of not less than 4 inches shall be provided between the exterior surface of chimneys for commercial and industrial type incinerators and combustible material.

(c) No woodwork shall be placed within 4 inches of the back face of a fireplace; nor shall combustible lathing, furring or plaster grounds be placed against a chimney at any point more than 1½ inches from the corner of the chimney; but this shall not prevent plastering directly on the masonry or on metal lath and metal furring; nor shall it prevent placing chimneys for low heat appliances entirely on the exterior of a building against the sheathing.

(d) The clearance between woodwork and a factory-built fireplace approved as a result of tests by a nationally recognized testing laboratory need not comply with paragraph (c) of this section provided the factory-built fireplace is installed in accordance with the conditions of approval.

(e) No woodwork shall be placed within 6 inches of a fireplace opening. Woodwork above and projecting more than 1½ inches from a fireplace opening shall not be placed less than 12 inches from the top of a fireplace opening.

(f) All spaces between chimneys and wood joists, beams or headers shall be firestopped by placing noncombustible material to a depth of one inch at the bottom of such spaces.

(g) All spaces back of combustible mantels shall be filled with noncombustible material.

SECTION 808. INTERIOR FINISH.**808.1. General.**

Interior finish shall include the exposed interior surfaces of buildings where the surface is an integral part of the building or

affixed thereto. Ordinary paint or wallpaper, floor coverings, curtains, draperies and other furnishings shall not be deemed to be interior finish.

808.2. Classification.

Interior finish materials shall be classified in accordance with their average flame spread rating on the basis of tests conducted in accordance with ASTM Standard No. E84.

808.3. Uses of interior finish.

(a) Interior finish materials used in buildings except dwellings, and except as provided in paragraph 808.3 (b), shall not have flame spread ratings greater than:

(1) 75 in exit stairways and exit hallways that are part of exit ways required by section 602 or 603, unless the building is sprinklered;

(2) 75 in all portions of buildings more than 75 feet in height except that in rooms or spaces 1,500 square feet or less in area the interior finish materials may have a flame spread rating of not greater than 200, unless the building is sprinklered;

(3) 75 in all portions of buildings used for institutional occupancies, unless the building is sprinklered;

(4) 200 in all portions of buildings not required to have lower flame spread ratings by paragraphs (1), (2) or (3) of this section except that in rooms or spaces 1,500 square feet or less in area used for business, high hazard, industrial or storage occupancies the interior finish materials may have a flame spread rating of not greater than 500.

(b) Ten per cent of the aggregate wall and ceiling areas of any room, space, stairway or hallway may have a flame spread rating of not more than 200 where interior finish materials are required to have a lower flame spread rating. The area of doors, door casings, frames, jambs and bucks, window and transom frames and casings having flame spread ratings of 200 or less shall be included within the area allowed to have a flame spread rating of 200.

(c) The flame spread rating limitations in this section shall apply to both the exposed and back faces of interior finish materials when such materials are used in:

(1) Rooms, spaces and exit stairways and exit hallways that are part of required exit ways, more than 75 feet above grade; or

(2) Rooms or spaces used for institutional occupancies, theatres more than 45 feet in height or places of assembly; however, the flame spread rating limitations of this section shall not apply to back faces of interior finish materials when:

(a) The interior finish material is applied directly to an integral part of the building; or

(b) The interior finish material has a backing of non-combustible material; or

(c) The rooms, spaces and exit ways are sprinklered.

808.4. Firestopping in back of wainscoting and paneling.

Except in dwellings, all spaces between combustible wainscoting or paneling and the wall or partition to which it is attached shall be firestopped to form areas not exceeding 10 feet in any dimension.

SECTION 809. STANDPIPES.

809.1. Standpipes required.

Buildings, except open air parking garages that are required to be sprinklered by section 810.1, shall be equipped with standpipes as follows:

(a) Buildings exceeding one story and 50 feet but not more than 75 feet in height shall have standpipes not less than 4 inches in diameter.

(b) Buildings exceeding one story and 75 feet in height shall have standpipes not less than 6 inches in diameter.

(c) On stages arranged or intended for theatrical, operatic or similar performances, one 2½-inch standpipe on each side of the stage.

809.2. Number.

The number of standpipes shall be such that all parts of every floor area can be reached within 30 feet by a nozzle assumed to be attached to 100 feet of hose connected to a standpipe.

809.3. Location.

Standpipes shall be so located that they are protected against mechanical and fire damage. Outlets shall be located:

- (1) Within stairway enclosures; or
- (2) Outside or immediately inside of the exterior walls, within one foot of an exterior stairway or fire escape, or a vestibule or balcony constructed and arranged as required by section 605.4 and directly connected to a stairway enclosure; or
- (3) As near the stairway as possible.

809.4. Installation.

(a) Standpipes shall be installed to conform with nationally recognized good practice on matters not covered in this code.

(b) Where approval of appliances, fittings, valves, fire department connections and other devices is required in this section 809,

approval shall be based on tests and listing of such items by a nationally recognized testing laboratory.

(c) Only approved fittings and valves shall be used in the construction of standpipes.

(d) Standpipes shall be of wrought iron or steel and shall be designed to withstand the pressures to which they may be subjected, but in no case shall they be designed to withstand a working pressure of less than 100 pounds per square inch in excess of the static head of water due to the height of the standpipe.

(e) Standpipes shall extend from the lowest story of the building to the topmost story; provided that standpipes serving parts of buildings that are not of the full height of the building, need extend only to the top story of that part.

(f) Connections to each water supply, except fire department hose connections, shall be provided with a check valve and a gate valve located close to the supply.

(g) Standpipes shall be equipped in every story with 2½-inch hose connections and valves located not more than 6 feet above the floor level. Easily removable 2½-inch by 1½-inch adapters may be placed in standpipe outlets.

809.5. Fire department connection.

(a) Standpipes shall be equipped with approved outside Siamese connections. The pipe from the standpipe to the Siamese connection shall be at least 4 inches in diameter.

(b) There shall be at least one Siamese connection to each standpipe system.

(c) Siamese connections shall be placed not less than 18 inches nor more than 36 inches above the level of the adjoining ground or sidewalk.

(d) The thread of such connections shall be uniform with that used by the local fire department. Substantial caps to protect the threads shall be provided on each connection.

(e) Each such connection shall be suitably marked with raised letters reading "Standpipe."

(f) Just inside of the building in a horizontal section of the standpipe connection, an approved straightway check valve shall be placed, with an automatic drip connection valve between the check valve and the exterior Siamese connection to prevent freezing.

809.6. Hose.

(a) Standpipes located inside of buildings shall have approved 1½-inch or 2½-inch hose, sufficient to reach all parts of the floor area, attached to each outlet.

(b) Each line of hose shall be provided with an approved nozzle. For 2½-inch hose the nozzle shall have a discharge outlet of 1 to 1⅛ inches.

(c) Hose shall be kept on approved hose racks or in approved hose cabinets.

809.7. Water supply

(a) Standpipes shall be supplied under full pressure from an adequate water supply or the water supply shall be furnished automatically by the opening of a hose outlet.

(b) The water supply shall be sufficient to provide not less than 250 gallons per minute for one standpipe and not less than 400 gallons per minute in buildings where 2 or more standpipes are required, for a period of at least 12½ minutes. The flowing pressure at outlets in the top story of a building shall be not less than 20 pounds per square inch.

(c) Where the hydrostatic pressure at any standpipe outlet for 1½-inch hose exceeds 100 pounds per square inch, an approved device shall be installed at the outlet to reduce the pressure to such a value that the nozzle pressure will be approximately 80 pounds per square inch.

(d) When a tank which supplies a standpipe is also used for domestic supply, the inlet to the domestic supply pipe shall be placed at a sufficient height above the bottom of the tank to reserve for fire purposes not less than the quantity of water specified for such purposes.

809.8. Tests.

Upon the completion of a standpipe installation the standpipe shall be tested hydrostatically at not less than 200 pounds per square inch pressure for 2 hours, or at 50 pounds per square inch in excess of the normal pressure when the normal pressure is in excess of 150 pounds per square inch.

SECTION 810. SPRINKLERS.

810.1. Sprinklers required.

In buildings erected, or altered to increase the area or height, approved automatic sprinkler systems shall be installed and maintained in accordance with the following paragraphs. The areas referred to shall be the area enclosed by exterior walls or fire walls or a combination thereof, except that in buildings of fire-resistive construction the area shall be that enclosed by exterior walls, fire walls or walls of noncombustible material having a fire resistance rating of not less than 2 hours, or a combination thereof. Combustible goods or merchandise shall include those made of wood, paper or rubber; those containing flammable liquids; those packed

with excelsior, moss or paper; and other goods or merchandise of equivalent or greater combustibility.

(a) Buildings over 2 stories in height used for the manufacture, sale or storage of combustible goods or merchandise (not including garages) and exceeding in area 10,000 square feet when of fire-resistive construction.

(b) Buildings over 2 stories in height used for the manufacture, sale or storage of combustible goods or merchandise (not including garages) and exceeding in area 8,000 square feet when of protected noncombustible construction

(c) Buildings over 2 stories in height used for the manufacture, sale or storage of combustible goods or merchandise (not including garages) and exceeding in area 6,000 square feet when of unprotected noncombustible construction, heavy timber construction, ordinary construction or wood frame construction.

(d) Buildings over 50 feet in height used for storage of combustible goods or merchandise (not including garages), regardless of area, when of fire-resistive type B construction or of protected noncombustible construction.

(e) Buildings over 35 feet in height used for storage of combustible goods or merchandise (not including garages), regardless of area, when of heavy timber construction, of ordinary construction or of unprotected noncombustible construction.

(f) Buildings exceeding 2 stories in height or in excess of 2,000 square feet in area on any floor above the first or ground floor, which do not have suitable access, as defined in this paragraph, to each story above the basement on at least one accessible side of the building. Suitable access shall be deemed as requiring an opening for fire department use through the wall at each story at least 32 inches wide, 48 inches high and with the sill not more than 32 inches above the floor; the openings shall be so spaced that there will be one opening in each 50 feet of exterior wall on an accessible side of the building.

(g) Enclosed parking garages over 65 feet in height and exceeding in area, 10,000 square feet if of fire-resistive construction or 8,000 square feet if of protected noncombustible construction or 6,000 square feet if of heavy timber construction or ordinary construction.

(h) Open air parking garages over 65 feet in height and exceeding 15,000 square feet in area.

(i) Repair garages.

(1) Repair garages over one story in height or located below another occupancy, exceeding 10,000 square feet in area when of fire-resistive construction, 8,000 square feet in area when of protected noncombustible construction, or 6,000 square

feet in area when of unprotected noncombustible construction, heavy timber construction, ordinary construction or wood frame construction.

(2) One-story repair garages exceeding 15,000 square feet in area when of fire-resistive construction, 12,000 square feet in area when of protected noncombustible construction, 9,000 square feet in area when of unprotected noncombustible construction, heavy timber construction or ordinary construction, or 6,000 square feet in area when of wood frame construction.

(j) Basements having an area exceeding 2,500 square feet, when used for the manufacture, sale or storage of combustible goods or merchandise, (not including garages). In buildings used for assembly, educational, institutional or residential occupancies, the automatic sprinkler systems shall be required only in such portions of the basement as are used for storage purposes or as work shops.

(k) Basement garages below other occupancies and exceeding 5,000 square feet in area.

(l) In places of assembly having a stage complying with section 320.1—at all locations on the stage side of the proscenium opening such as under the roof of the stage, under the gridiron, the rigging loft and fly and tie galleries, under the stage, in dressing rooms, scene docks, workshops and storage rooms.

810.2. Installation.

(a) Automatic sprinkler systems required in this code shall be installed to conform with nationally recognized good practice on matters not covered in this code and in accordance with detailed drawings of the complete sprinkler layout which shall have been submitted to and approved by the building official.

(b) Where approval of sprinklers, fittings, valves or fire department connections is required in this section 810 approval shall be based on tests and listing of such items by a nationally recognized testing laboratory.

(c) Sprinkler systems shall be designed to withstand, when ready for service, a water pressure of not less than 200 pounds per square inch for two hours or at 50 pounds per square inch in excess of the maximum static pressure when the maximum static pressure is in excess of 150 pounds, without leakage at joints, valves, fittings or any part of the piping.

(d) When ready for service, the entire system shall be inspected and tested in the presence of the building official. Defects developed by such inspection and test shall be corrected before final approval.

(e) Only approved sprinklers, fittings and valves shall be used in the installation of sprinkler systems.

(f) Every sprinkler system shall be provided with an approved outside screw and yoke valve or indicator gate valve, located to be readily accessible, to control all sources of water supply except that from the fire department connection.

(g) Branches from underground water mains and new underground water mains for sprinkler systems shall be flushed out thoroughly before connecting them to the sprinkler riser.

810.3. Water supply.

Each automatic sprinkler system shall have at least one automatic water supply of adequate pressure, capacity and reliability.

810.4. Fire department connections.

(a) Every sprinkler system shall be equipped with at least one approved fire department connection. The pipe from the sprinkler system to the hose connection shall be not less than 4 inches in size, except that 3-inch pipe may be used to connect a single hose connection to a 3-inch or smaller riser.

(b) Hose connections shall be so located as to permit prompt and easy attachment of hose.

(c) The thread of such connection shall be uniform with that used by the local fire department.

(d) Each such connection shall be suitably marked with raised letters reading, "AUTO. SPRINKLERS," or, when only stories below grade are equipped, "BASEMENT SPRINKLERS" (or "CELLAR SPRINKLERS").

(e) An approved straightway check valve shall be installed in each fire department connection, located as near as practicable to the point where it joins the system. The pipe between the outside hose connection and the check valve shall be arranged to drain in an approved manner.

ARTICLE IX.**DESIGN LOADS AND GENERAL BUILDING REQUIREMENTS.****SECTION 900. QUALITY AND TEST OF WORKMANSHIP.**

(a) Workmanship in the fabrication, preparation and installation of materials shall conform to generally accepted good practice. Specific provisions of this article shall not be deemed to suspend any requirements of good practice, but shall be regarded as supplementing or emphasizing them, and shall be controlling.

(b) In case there is reason to question the safety of a floor or other structural part of a building or structure in course of construction or before a certificate of occupancy has been issued, the building official may require load tests or other suitable tests to determine the acceptability of the construction. Such tests shall be made under the supervision of the building official. The tests shall be made with a superimposed load equal to not less than twice the design live load, and within 24 hours after the load is removed the assembly shall recover at least three-quarters of the maximum deflection.

SECTION 901. WORKING STRESSES, GENERAL.

(a) Buildings and structures and all portions thereof shall be designed and constructed to support all live loads in addition to the dead loads, whether permanent or temporary, without exceeding the allowable stresses specified in this article for the materials in the structural members and connections. In using these stresses, the effects of all loads and conditions of loading and the influence of all forces, affecting the design and strength of the several parts shall be taken into account.

(b) Temporary supports placed in or under a building or structure or any portion thereof shall be of sufficient strength to carry the load to be supported without exceeding the allowable stresses specified in this article for the materials in the structural members and connections.

(c) Higher stresses than specified in this article may be used only if it is clearly established, by test or other approved evidence, that material of a higher grade or a superior workmanship is to be employed. The use of higher stresses, however, shall not be allowed until a statement, giving the reasons for such permission, together with the facts and circumstances on which it is based, is placed on file and made a part of the official record of the permit.

SECTION 902. LIVE LOADS.

902.1. Floor loads.

Floors in a building or structure shall be designed and constructed for the greatest loads that probably will be produced by the intended use or occupancy, but in no case less than the following live loads per square foot of area uniformly distributed, according as the floor may be intended to be used for the purposes indicated:

Occupancy	Live Load Lbs. per Sq. Ft.
Assembly:	
Armories and drill rooms	150
Assembly halls, auditoriums, churches, lecture halls, lodge rooms and similar assembly occupancies.	
Fixed seats	60
Movable seats	100
Bowling alleys, poolrooms and similar recreational areas	75
Dance halls, dining rooms, exhibition rooms, grand- stands, gymnasiums, museums, passenger sta- tions, restaurants, reviewing stands, skating rinks	100
Ice skating rinks	250
Theatres:	
Aisles, corridors, lobbies, projection rooms	100
Dressing rooms	40
Orchestra floors, balconies	60
Stage floors	150
Business:	
Offices	80
Letter file rooms	80
Card file rooms	125
Educational:	
Libraries:	
Corridors	100
Reading rooms	60
Stack rooms	150
Schools and colleges:	
Classrooms	40
Corridors	100
Industrial:	
Bakery	150
Factories and manufacturing plants	125
Foundries	600
Ice manufacture	300

Occupancy	Live Load Lbs. per Sq. Ft.
Industrial, continued:	
Laboratories, scientific	100
Laundries	150
Printing plant:	
Composing room	100
Linotype room	100
Press	150
Paper storage	50 lbs. per ft. of clear story height
Institutional:	
Hospitals, asylums, infirmaries, sanitariums:	
Operating rooms	60
Private rooms	40
Wards	40
X-Ray rooms	100
Nurseries, orphanages, homes for the aged	40
Penal institutions, reformatories, jails, houses of correction:	
Cell blocks	40
Corridors	100
Mercantile:	
Retail:	
First-floor, rooms	100
Upper floors	75
Wholesale	125
Residential:	
Dormitories:	
Partitioned	40
Nonpartitioned	80
Dwellings:	
First floor	40
Upper floors and habitable attics	30
Uninhabitable attics	20
Hotels, motels, lodging houses:	
Corridors serving public rooms	100
Guest rooms	40
Public corridors	60
Public rooms	100
Private corridors	40
Multifamily houses, tenements:	
Corridors	60
Private apartments	40
Public rooms	100

Occupancy	Live Load Lbs. per Sq. Ft.
Storage:	
Parking Garages: (See section 902.3)	
Passenger cars	100
Trucks, with load, 3 to 10 tons	150
Trucks, with load, more than 10 tons	200
Cold storage:	
No overhead system	250
	plus 150 for trucks
Overhead system:	
Floor	150
Roof	250
Storage, hay or grain	300
Storage warehouse, light	125
Storage warehouse, heavy	250

When occupancies or uses not listed above are involved, the live load shall be determined in a manner satisfactory to the building official.

902.2. Provision for partitions.

In portions of buildings used for offices or other buildings where partitions might be subject to erection or rearrangement, provision for partition weight shall be made, whether or not partitions are shown on the plans, unless the design live load exceeds 80 pounds per square foot.

902.3. Concentrated floor loads.

Floors in buildings or portions thereof used for business, industrial or storage occupancies shall be designed to sustain safely a concentrated load of 2,000 pounds placed upon any space $2\frac{1}{2}$ feet square wherever such load upon an otherwise unloaded floor would produce stresses greater than the uniformly distributed load for which the floor is designed. Floors in garages for passenger cars shall be designed for 150 per cent of the maximum wheel load anywhere on the floor. Floors in garages for trucks or used for automotive trucking shall be designed for 125 per cent of the maximum axle load anywhere on the floor.

902.4. Stairways and balconies.

(a) Stairways and balconies, both exterior and interior, shall be designed to safely sustain the following loadings taken one at a time:

1. A live load of 100 pounds per square foot;
2. A concentrated load of 300 pounds placed upon an area of $2\frac{1}{2}$ feet square so located as to produce maximum stress conditions.

(b) Stairway and balcony railings, both exterior and interior, shall be designed to resist a horizontal thrust of 50 pounds per lineal foot applied to the top of the railing.

902.5. Roof loads.

(a) Ordinary roofs, either flat, pitched or curved shall be designed for a load of not less than 20 pounds per square foot of horizontal projection in addition to the dead load, and in addition to either the wind or other loads, whichever produces the greater stresses.

(b) When a roof, in addition to serving as a closure of a building or structure, is to be used as a floor, it shall be designed to carry safely the live load to be imposed but not less than the minimum live load prescribed in this section for floors.

(c) Scuttles, ribs of skylights and accessible ceilings shall be designed to support a concentrated load of 200 pounds occupying an area of $2\frac{1}{2}$ feet square and so placed as to produce maximum stresses in affected members.

902.6. Sidewalk loads.

For sidewalks over vaults, areaways and similar structures the live load shall be 250 pounds per square foot uniformly distributed and where such sidewalks are subject to trucking, they shall be capable of safely sustaining a concentrated load of 8,000 pounds placed upon an area of $2\frac{1}{2}$ feet square so located as to produce maximum stress conditions.

902.7. Impact loads.

The live loads given in this section include adequate allowance for ordinary impact conditions however, where uses or loads involve unusual vibration or impact forces, provision shall be made in the structural design for such forces in accordance with the following:

(a) All moving elevator loads shall be increased 100 per cent for impact.

(b) For the purpose of design, the weight of heavy machinery and moving loads shall be increased not less than 25 per cent for impact.

(c) All craneways shall be designed to resist a horizontal transverse force equal to 25 per cent of the sum of the crane capacity and the weight of the trolley; one-half of such sum to be applied at the top of each runway rail. In addition all craneways shall be designed to resist horizontal longitudinal force equal to $12\frac{1}{2}$ per cent of the total of the maximum wheel loads applied at the top of each rail.

(d) Where moving loads not specified above are involved the impact load shall be determined in a manner satisfactory to the building official.

902.8. Reduction in live loads.

(a) No reduction shall be applied to the roof live load.

(b) No reduction in live load shall be made for floor areas to be occupied as a place of assembly or for parking of motor vehicles.

(c) For live loads of 100 pounds or less per square foot, the design live load on any member supporting a floor area of 150 square feet or more may be reduced percentagewise by the least of the following percentages:

(1) 0.08 times square feet of area supported by the member.
per cent

$$(2) R = 100 \times \frac{D + L}{4.33L}$$

in which:

R = reduction in per cent

D = dead load per square foot of area supported by the member

L = design live load per square foot of area supported by the member

(3) 60 per cent.

Where a member supports floor areas from more than one story, reduction of the design live load on the member by method (1) shall be made on the floor areas taken one story at a time starting with the uppermost floor area supported by the member.

For live loads exceeding 100 pounds per square foot, no reduction shall be made, except that the design live loads on columns may be reduced 20 per cent.

902.9. Posting of live loads.

In buildings, structures or portion thereof used for business, industrial, mercantile or storage occupancies the live load for which each floor or part of a floor is designed and approved shall be conspicuously posted in that part of the story to which it applies.

902.10. Loading restricted.

No person shall place, or cause or permit to be placed, on any floor or roof of a building or structure a greater load than that for which such floor or roof is designed and approved.

SECTION 903. WIND PRESSURE.

903.1. When considered.

All buildings and structures shall be designed to resist a horizontal wind pressure on all surfaces exposed to the wind, allow-

ing for wind in any direction, in accordance with the following table. No allowance shall be made for the shielding effect of other buildings or structures. The height is to be measured above the average level of the ground adjacent to the building or structure.

Height Zone (Feet)	Wind Pressure (Lbs. per Sq. Ft.)
Less than 30	15
30-49	20
50-99	25
100-499	30
500-1199	35
1200 and above	40

903.2. Exterior walls.

Exterior walls shall be designed to withstand the pressures specified in section 903.1, acting either inward or outward.

903.3. Roofs.

(a) The roofs of buildings and structures shall be designed and constructed to withstand pressures, acting outward normal to the roof surface, equal to $1\frac{1}{4}$ times the pressures specified in section 903.1. The height is to be taken as the vertical distance from the average elevation of the ground adjoining the building to the average elevation of the roof.

(b) Roofs or sections of roofs with slopes greater than 30° shall be designed to withstand pressures, acting inward normal to the surface, equal to those specified in section 903.1 and applied to the windward slope only.

903.4. Chimneys, tanks and towers.

Chimneys, tanks, solid towers and similar structures shall be designed and constructed to withstand the pressures specified in section 903.1 multiplied by the following factors:

Shape in Horizontal Cross Section	Factor
Square or rectangular	1.00
Hexagonal or octagonal	0.80
Round or elliptical	0.60

903.5. Other structures.

The design wind pressures for structures not covered in this section 903 shall be in accordance with generally accepted engineering practice and shall be subject to the approval of the building official.

903.6. Stability.

The overturning moment due to wind pressure shall not exceed $66\frac{2}{3}$ per cent of the moment of stability due to the dead load only, unless the building or structure is securely anchored to the foundation to resist this force.

903.7. Signs and outdoor display structures.

(a) For the purpose of determining wind pressures all signs shall be classified as either open or solid. Signs in which the projected area exposed to wind consists of 70 per cent or more of the gross area as determined by the over-all dimensions shall be classed as solid signs; those in which the projected exposed area is derived from open letters, figures, strips, and structural framing members, the aggregate total area of which is less than 70 per cent of the gross area so determined, shall be classed as open signs.

(b) All signs shall be designed and constructed to withstand wind pressures applied to the projected exposed area, allowing for wind in any direction, in accordance with the following table:

Height from Ground to Top of Sign in Feet	Wind Pressure Pounds per Square Foot	
	Solid Signs	Open Signs
Less than 30	17	23
30-49	22	31
50-99	28	39
100-499	33	46

For ground signs 30-49 feet in height the tabular values for heights of less than 30 feet may be used.

SECTION 904. EXCAVATIONS.

904.1. General.

(a) Until provision for permanent support has been made, excavations shall be properly guarded and protected to prevent the same from becoming dangerous to life or limb, and, where necessary, shall be sheetpiled or braced to prevent the adjoining earth from caving in, by the person causing the excavation to be made.

(b) The person causing any excavation to be made shall prevent the movement of the earth in the adjoining property and the trees and natural objects thereon or therein and maintain or restore all public sidewalks, curbs, pavements and the property of public utilities located within street lines, which may be affected by the excavation.

904.2. Support of neighboring buildings and structures.

(a) When an excavation extends not more than 10 feet below the curb level nearest the point of excavation under consideration, or below the surface of the ground where there is no such curb level, the owner of a building or structure adjacent to the excavation, the safety of which may be affected by such excavation, shall be notified in writing by the one causing the excavation to be made at least one week before the excavation is commenced. The owner of the adjoining structure shall preserve and protect the same from injury and, when necessary, shall underpin and

support the same by proper foundations. For such purpose, he shall be permitted, if necessary, to enter upon the premises where such excavation is being made.

(b) When an excavation extends more than 10 feet below curb level nearest the point of excavation under consideration, or below the surface of the ground where there is no such curb level, the person causing such excavation to be made shall, if afforded the necessary consent to enter upon the adjoining land, at his own expense, preserve and protect from injury every building or structure, the safety of which may be affected by such excavation and, when necessary, shall underpin and support the same by proper foundations, irrespective of the depth to which the foundations of such building or structure may extend. If the necessary consent is not accorded to the person making the excavation, then it shall be the duty of the person refusing such consent to preserve and protect such building or structure from injury and, when necessary, to underpin and support the same by proper foundations; and for that purpose such person shall, when necessary, be permitted to enter upon the premises where such excavation is being made.

(c) In case there is a wall adapted for joint service between two buildings along a lot line of the premises where an excavation is being made, the person causing the excavation to be made, shall at his own expense, preserve such wall in as safe a condition as it was before the excavation was commenced and shall, when necessary, underpin and support the same by proper foundations.

(d) In case a building or structure is so located that the curb level to which it is properly referred is at a higher level than the curb level to which the excavation is referred, such part of the necessary underpinning or foundation as may be due to the difference in the curb levels, shall be made and maintained at the joint expense of the owners of the adjoining premises at that point.

SECTION 905. FOUNDATIONS, GENERAL.

905.1. General requirements.

(a) Foundations shall conform with nationally recognized good practice on matters not covered in this code.

(b) Except when erected upon hardpan or solid rock or upon walls or piers on the water front, foundation walls or other permanent supports shall be carried below the frost line and shall rest on solid ground or on leveled rock, or on piles or ranging timbers when solid earth or rock is not found; except that for one-story buildings of wood frame construction, ordinary construction or unprotected noncombustible construction used for purposes other than dwelling and not exceeding 500 square feet in

area, such foundation walls or other permanent supports shall not be required.

905.2. Footings.

(a) Footings shall be provided under walls where required to distribute the loads on the walls in accordance with the allowable unit bearing values of the supporting soils given in section 906 and under all columns whose loads are to be transmitted directly to the soil.

(b) Footings shall consist of masonry, reinforced concrete or steel grillages. Footings of wood may be used if they are entirely below permanent water level or if they are pressure impregnated with creosote or other approved preservative as specified for timber piles in section 908.2.

(c) Where metal is incorporated in or forms part of a foundation, except reinforcing steel in concrete and steel grillages encased in concrete, it shall be protected from rust by paint, asphalt, concrete, or by such materials and in such manner as may be approved by the building official.

905.3. Footing loads.

The full dead load, including the weight of the footings, foundations, the overlying fill, and the reduced required live loads on the lowest walls, piers or columns shall be considered in proportioning and designing the footings.

905.4. Design.

(a) Footings shall be so designed that the pressure on the soil per unit of area shall, so far as possible, be uniform under all parts of the building or structure.

(b) The areas of footings shall be in proportion to the full dead loads, including the weight of the footings; in no case shall the full dead loads plus the live loads reduced in accordance with section 902.8 cause a pressure under the footing exceeding the soil bearing capacity permitted by section 906.

SECTION 906. SOIL BEARING VALUES.

906.1. Subsurface explorations.

Before issuing a permit for the erection or alteration of a building or structure, the building official, in the absence of data satisfactory to him, may require the owner to make borings, dig test pits, or make tests of a satisfactory character at such locations, and carried to such depths as will disclose the character of any materials underlying the site of the proposed building or structure which may affect the stability or settlement of the structure. Such records shall be certified by a competent engineer or architect. Complete records of the results of all subsurface explorations shall be filed with the building official.

906.2. Presumptive capacity.

(a) In the absence of satisfactory tests, the bearing value per square foot of soils shall be deemed to be as follows:

Soft clay, medium	1.5 tons
Medium stiff clay	2.5 tons
Sand, fine, loose	2 tons
Sand, coarse, loose; compact fine sand; and loose sand-gravel mixture	3 tons
Gravel, loose; and compact coarse sand	4 tons
Sand-gravel mixture, compact	6 tons
Hardpan and exceptionally compacted or partially cemented gravels or sands	10 tons
Sedimentary rocks such as hard shales, sandstones, limestones, silt stones, in sound condition	15 tons
Foliated rocks such as schist or slate in sound condition	40 tons
Massive, bed rock, such as granite, diorite, gneiss, trap rock, in sound condition	100 tons

(b) Where portions of the foundation of an entire building or structure rest directly upon, or are underlain by, medium or soft clay upon different materials, or where the layers of such softer materials vary greatly in thickness, the magnitude and distribution of the probable settlement shall be investigated, and, if necessary, the allowable loads shall be reduced or special provisions made in the design of the building or structure to prevent serious differential settlements which will impair the safety of the structure.

(c) Where the bearing materials directly under a foundation overlie a stratum having smaller allowable bearing values, such smaller values shall not be exceeded at the level of such stratum. Computation of the vertical pressure in the bearing materials at any depth below a foundation shall be made on the assumption that the load is spread uniformly at an angle of 60 degrees with the horizontal.

906.3. Soil tests.

(a) Whenever the allowable load on a soil is in doubt, the building official may require field loading tests to be made by and at the expense of the owner of the proposed building or structure to determine the sustaining power of the soil. Whenever such a test is made the building official shall be notified so that he may be present in person or by representative. The proposed testing apparatus and test procedure shall be subject to the approval of the building official. A complete record of the test shall be filed with the building official.

(b) The proposed safe load shall be allowed if the increment of settlement obtained under 50 per cent overload does not exceed

60 per cent of the settlement obtained under the proposed safe load. The settlement under the allowed load shall not exceed $\frac{1}{2}$ inch. If, at the proposed safe load, the above conditions are not satisfied, the allowable bearing value shall be reduced accordingly.

906.4. Fill material, organic material and silt.

No foundation of a building or structure shall be placed on fill material, organic material or silt until evidence has been presented to the building official showing that the proposed load will be adequately supported.

SECTION 907. FOUNDATION WALLS.

907.1. Materials.

Foundation walls shall be built of masonry, reinforced concrete, or steel encased in masonry; provided that when structural clay tile is used it shall meet the requirements to resist frost action in the presence of moisture in accordance with nationally recognized good practice.

907.2. Thickness.

(a) Foundation walls shall be of adequate strength and thickness to resist lateral pressures from adjacent earth and to support their vertical loads; but the thickness shall be not less than the actual thickness of walls supported by them, except as permitted by paragraph (b) below, and shall be not less than the minimum thicknesses specified in paragraphs (c) and (d) below.

(b) Where 8-inch foundation walls are permitted by paragraph (c), such walls may be used as foundations for dwellings with walls of brick veneer on wood frame walls, or with 10-inch cavity walls; provided that the dwelling is not more than $1\frac{1}{2}$ stories in height and the total height of the wall, including the gable, is not more than 20 feet. Such walls shall be corbelled with solid units to provide a bearing the full thickness of the wall above, unless adequate bearing is provided by a concrete floor slab. The total projection shall not exceed 2 inches with individual corbels projecting not more than $\frac{1}{3}$ the height of the unit. The top corbel course shall be not higher than the bottom of floor joists and shall be a full header course of headers at least 6 inches in length.

(c) Foundation walls shall be not less than 12 inches thick, except as follows:

(1) Masonry foundation walls supported laterally at vertical intervals not exceeding 12 feet may be 8 inches thick if reinforced by means of vertical $\frac{3}{8}$ -inch diameter deformed reinforcing bars, or the equivalent, spaced not more than 12 inches apart and not less than $3\frac{1}{2}$ inches from the pressure side of the wall; or $\frac{1}{2}$ -inch diameter deformed reinforcing

bars, or the equivalent, spaced not more than 24 inches apart and not less than 5 inches from the pressure side of the wall. The reinforcing bars shall extend from the footing to the top of the foundation wall and shall be lapped at least 30 diameters at splices. The space between each reinforcing bar and the enclosing masonry surfaces shall be solidly filled with Type A-1 grout or mortar.

(2) Solid masonry walls that do not extend more than 5 feet below the adjacent finished ground level, and walls of hollow units that do not extend more than 4 feet below the adjacent finished ground level, may be 8 inches thick; masonry bonded hollow walls that do not extend more than 4 feet below the adjacent finished ground level may be 10 inches thick. The depth may be increased to 7 feet with the approval of the building official when he is satisfied that soil conditions warrant such increase. The total height of an 8-inch foundation wall and the wall supported shall not exceed that permitted by section 909.5 for 8-inch walls.

(3) Foundation walls of cast-in-place concrete shall be at least 8 inches thick; provided that when the basement floor does not exceed 4 feet below grade, such walls may be 6 inches thick.

(d) Foundation walls of rubble stone shall be at least 16 inches thick. Rough or random rubble shall not be used as foundations for walls exceeding 35 feet in height.

907.3. Waterproofing and dampproofing.

If by reason of dampness in the ground, the building official shall deem it necessary to do so, foundation walls below the adjacent ground level shall be rendered waterproof or dampproof as conditions require by an approved process.

SECTION 908. PILE FOUNDATIONS.

908.1. General.

(a) Pile foundations shall conform with nationally recognized good practice on matters not covered in this code.

(b) Piles shall be driven to solid bearing where practicable. The method of driving shall be such as not to impair their strength.

(c) Where the boring records or site conditions indicate possible deleterious action on pile materials because of soil constituents or of changing water levels, such pile materials shall be adequately protected by approved preservatives, impervious encasements or other approved means which will not be rendered ineffective by driving and which will prevent such deleterious action; or in lieu of such protection the design loads or stresses shall be reduced.

(d) All piles shall be accurately spotted, driven plumb, with the butt, and point, if necessary, protected from injury during driving. Injured or broken piles shall not be used.

(e) The allowable load on piles shall be as determined by an approved formula or by a loading test but under no circumstances shall the design load produce compressive stresses on any cross-section of a pile in excess of the stresses specified in sections 908.2, 908.3, 908.4 and 908.5.

(f) Where any doubt exists as to the safe load-carrying capacity of any pile the building official may order a loading test to be made on the pile at the expense of the owner.

(g) The safe load-carrying capacities may be determined by means of loading tests performed on not less than 2 typical piles of an installation and, where deemed necessary by the building official, on not less than one pile for each 15,000 square feet of building area. The test load shall be twice the proposed load value of the pile and shall be applied in 6 equal increments starting with $\frac{1}{2}$ the proposed working load. After the proposed working load has been applied and for each increment thereafter, the test load shall remain in place until there is no settlement in a 2-hour period. The total test load shall remain in place until settlement does not exceed $\frac{1}{1000}$ of a foot in 48 hours. The total test load shall be removed in decrements not exceeding $\frac{1}{4}$ of the total test load with intervals of not less than one hour. The rebound shall be recorded after each decrement is removed, and the final rebound shall be recorded 24 hours after the entire test load has been removed. The maximum allowable pile load shall be $\frac{1}{2}$ that which causes a net settlement after deducting the rebound of not more than $\frac{1}{100}$ of an inch per ton of total test load or shall be $\frac{1}{2}$ that which causes a gross settlement of one inch, whichever is less. Elastic shortening of the pile shall not be included in the gross settlement.

(h) The use of types of piles not specifically mentioned herein, and the use of piles under conditions not specifically covered herein, may be permitted, subject to the approval of the building official, upon the submission of acceptable test data, calculations and other information relating to the structural properties and load-carrying capacity of such piles. Prior to giving such approval the building official may require any information or demonstrations which he deems necessary for the determination of the adequacy of the design or of the suitability of the method of installation. In no case shall the allowable design load exceed that determined in accordance with the provisions of this section.

(i) If the supporting capacity of a single row of piles is sufficient to adequately support a structure, the piles shall be driven alternately to the left and right of the center line of the wall, the centers of the piles being at least $\frac{1}{2}$ their cut-off diameter distance

from the center line of the wall, except in wood frame structures where piles may be driven in a single row.

(j) The minimum distance between centers of piles not driven to rock shall be not less than twice the average diameter of a round pile, nor less than twice the diagonal dimension of a rectangular or rolled structural steel pile, nor less than 2 feet 6 inches. The minimum distance between centers of piles driven to rock shall be not less than the greatest diameter of a round pile plus one foot, nor less than the diagonal dimension of a rectangular or rolled structural steel pile plus one foot.

(k) Plain concrete used for capping of piles shall be not less than 12 inches thick above the tops of the piles, except that for one-story buildings of wood frame construction or unprotected non-combustible construction, the thickness shall be not less than 8 inches. When reinforced concrete is used for capping, the thickness of the edge shall be not less than 12 inches above the reinforcement and 2 inches between the top of the pile and steel reinforcement placed above it. The minimum horizontal distance from the edge of the cap to the nearest pile surface shall be 3 inches and all pile caps shall extend 3 to 4 inches below the cut-off of the piles. Timber capping shall be of dense, sound wood properly joined and attached to the piles.

908.2. Timber piles.

(a) Timber piles shall be sound straight timber and if round they shall have a reasonably uniform taper and shall conform with nationally recognized good practice for the various classes of piles.

(b) The compressive stress on any cross section of a round timber pile shall not exceed the following values:

Species	Allowable stress in pounds per square inch
Cedar, Douglas fir (mountain region), western hemlock, Norway pine or other woods of comparable strength	600
Cypress, Douglas fir (coast region), hickory, oak, southern pine or other woods of comparable strength	800

(c) Untreated piles used in permanent construction, except where used for light frame structures over water or marsh lands, shall be cut off below permanent water level.

(d) Piles of southern pine, Norway pine, Douglas fir or red oak when pressure treated by an empty cell process, with Grade One coal tar creosote to a net final retention of not less than 12 pounds of creosote per cubic foot of wood, may be used as follows: Where the upper portion of the pile is exposed and accessible for inspection, the cut-off may be above ground level or

water level; where the upper portion of the pile will not be readily accessible for inspection, the cut-off shall be below the ground level but may be above the ground-water level provided the tops are encased in masonry footings so that no part of the pile will be exposed to the air. The tops of the cut-off piles shall be treated with three coats of hot creosote.

(e) The treatment of other species of wood, conforming with nationally recognized good practice, for piles to extend above permanent ground-water level, and the use of other preservative materials or methods, may be used subject to written approval of the building official.

908.3. Concrete-filled steel pipe piles.

(a) Concrete-filled steel pipe piles driven open ended shall have a nominal outside diameter of not less than $10\frac{3}{4}$ inches and a nominal wall thickness of not less than $\frac{5}{16}$ inch except that pipes having a nominal outside diameter 14 inches or over shall have a nominal wall thickness of not less than $\frac{3}{8}$ inch. Concrete-filled steel tubular piles driven with ends closed may be of smaller sizes and wall thickness but no tapered pile shall have a diameter of less than 8 inches at the top nor 6 inches at the foot, and no such pile of uniform section shall have a diameter of less than 8 inches. The steel pipe shall conform with nationally recognized good practice.

(b) A forged, cast steel or flat plated end of approved design shall be used on concrete-filled steel pipe piles driven with a closed end.

(c) The compressive stress on any cross section of a concrete-filled steel pipe pile shall not exceed 22.5 per cent of the specified strength of the concrete which shall have an ultimate compressive strength at the end of 28 days of not less than 2,500 pounds per square inch, plus 9,000 pounds per square inch on the steel shell when it is $\frac{1}{10}$ of an inch thick or greater. No compressive stress shall be permitted on steel shells less than $\frac{1}{10}$ of an inch thick.

908.4. Concrete piles.

(a) Precast concrete piles shall not be driven before the concrete has attained a compressive strength of at least 3,000 pounds per square inch.

(b) The concrete for cast-in-place concrete piles shall have a minimum compressive strength at 28 days of 2,500 pounds per square inch and shall be so placed as to insure the exclusion of foreign matter and to insure a continuous and full sized pile. No cast-in-place pile shall have a diameter of less than 8 inches at the top or of less than 6 inches at the foot.

(c) The compressive stress on any cross section of a concrete pile whether precast or cast in place shall not exceed 22.5 per cent of its ultimate 28-day compressive strength.

(d) For precast concrete piles and cast-in-place concrete piles using no permanent casing, reinforcement shall have a minimum protective cover of $1\frac{1}{2}$ inches of concrete for both precast and cast-in-place piles except that for piles subjected to sea water or other severe exposure $2\frac{1}{2}$ inches protective cover of concrete shall be provided in the zone of such exposure. For cast-in-place concrete piles using metal casing no reinforcement shall be placed within one inch of the metal casing.

(e) Piles shall be driven in such order and with spacing as to insure against distortion or injury to piles already in place. No pile shall be driven within 10 feet of a pile filled with concrete less than 24 hours old.

908.5. Rolled structural steel piles.

(a) Rolled structural steel piles shall conform with nationally recognized good practice and shall be of H form, with flange projection not exceeding 14 times the minimum thickness of metal in either flange or web, and with total flange width at least 85 per cent of the depth of the section. No section shall have a nominal thickness of metal less than $\frac{3}{8}$ inch nor a nominal depth in the direction of the web of less than 8 inches.

(b) The allowable load on rolled structural steel piles shall not exceed 9,000 pounds per square inch.

SECTION 909. MASONRY.

909.1. Materials.

(a) All masonry shall be constructed of approved materials.

(b) Dimensions specified are nominal unless otherwise stated; actual dimensions may vary from the nominal by the thickness of a mortar joint, but not more than one-half inch.

(c) The quality of masonry building materials shall conform with nationally recognized good practice when the quality is not specified in this code.

(d) Existing masonry may be used without change, if in good condition; provided the stresses in the masonry under the new conditions do not exceed the working stresses permitted by this code.

909.2. Construction.

(a) All masonry shall be protected against freezing for at least 48 hours after being placed. Unless adequate precautions against freezing are taken, no masonry shall be built when the temperature is below 32° Fahrenheit on a rising temperature or below 40° on a falling temperature, at the point where the work is in progress. No frozen materials shall be built upon.

(b) Except when carried independently by girders at each floor, no wall shall be built up more than 25 feet in height in advance of other walls of the building.

(c) Masonry walls shall be securely bonded or anchored in an approved manner at points where they intersect; where they abut or adjoin the frame of a steel or reinforced concrete frame building; and where they intersect floors or columns and are dependent upon them for lateral support.

(d) Except for window-paneled backs and permissible chases and recesses, walls shall not vary in thickness between their lateral supports. When a change in thickness, due to minimum thickness requirements, occurs between floor levels, the greater thickness shall be carried up to the higher floor level.

(e) The unsupported height of piers shall not exceed 10 times their least dimension. Hollow masonry units shall not be used for isolated piers to support beams and girders when the unsupported height of the piers exceeds 4 times their least dimension unless the cellular spaces are filled solidly with concrete or either Type A-1 or A-2 mortar.

(f) Door and window openings in walls shall be spanned by well buttressed arches, or by lintels having bearings proportioned to their loads but not less than 4 inches.

(g) Except for wood piles, no masonry shall be supported on wood girders or other form of wood construction; however, this shall not prohibit the placing in masonry of wood nailing blocks not exceeding 2 by 4 by 8 inches in size; nor shall it prohibit in buildings of ordinary construction, the placing of wood lintels over openings, on the inside of the wall, resting at each end not more than two inches on the wall, and chamfered or cut to serve as centres for masonry arches; nor shall it prohibit the placing in masonry of wood members used for decorative purposes where the wall exceeds 8 inches in thickness.

(h) During erection, walls shall be adequately braced and arches temporarily supported.

(i) Under-burned clay bricks shall not be used in any part of a building or structure where exposed to the weather, nor in isolated piers, nor in such part of a bearing wall above which the wall extends more than 40 feet.

(j) Gypsum partition tile or block shall not be used in bearing walls, or where subject to continuous dampness. Gypsum partition tile shall not be used for partitions to receive portland cement plaster for ceramic tile, marble or structural glass wainscots unless self-furring metal lath is first placed over the gypsum tile.

(k) Clay or shale brick shall be wetted when laid unless their gain in weight resulting from partial immersion flatwise in

$\frac{1}{8}$ inch of water for one minute is less than $\frac{3}{4}$ ounce per 30 square inches of immersed area.

(1) Horizontal and vertical joints in brick masonry shall be filled with mortar.

909.3. Mortar.

(a) Mortar used in masonry construction shall be classified as follows:

Type	Average compressive strength of 2-inch cubes at 28 days, pounds per square inch.
A-1	2,500 or above
A-2	1,800 to 2,500
B	750 to 1,800
C	350 to 750
D	75 to 350

(b) Where the classification has not been established by a compressive strength test approved by the building official, mortars proportioned in accordance with the following table shall be assumed to be of the types indicated.

Mortar Proportions

Mortar Type	Proportions by Volume			
	Portland Cement	Masonry Cement (type II) ASTM C91	Hydrated Lime or Lime Putty	Aggregate, measured in a damp and loose condition
A-1	1	1	-----	
	1	---	$\frac{1}{4}$	$2\frac{1}{4}$ to 3
A-2	$\frac{1}{2}$	1	-----	times the
	1	---	$\frac{1}{4}$ to $\frac{1}{2}$	sum of the
B	---	1	-----	volumes or
	1	---	$\frac{1}{2}$ to $1\frac{1}{4}$	the cement
C	---	1	-----	and lime
	1	---	$1\frac{1}{4}$ to $2\frac{1}{2}$	used
D	1	---	$2\frac{1}{2}$ to 4	

(c) Grout shall be Type A-1, Type A-2, or Type B mortar to which is added water to produce consistency for pouring without segregation of constituents of the mortar. Type A-1 grout shall be used with Type A-1 mortar; either Type A-1 or Type A-2 grout shall be used with Type A-2 mortar; Type A-1, Type A-2 or Type B grout shall be used with Type B mortar.

(d) Gypsum mortar shall be composed by weight of one part of gypsum and not more than three parts of mortar aggregate.

(e) Type of mortar required. Masonry shall be laid in mortar of the types specified in the following table:

Kind of Masonry	Type of Mortar Required
Foundations:	
Footings	A-1 or A-2
Walls of solid units	A-1, A-2, or B
Walls of hollow units	A-1 or A-2
Hollow walls	A-1 or A-2
Masonry other than foundation masonry:	
Piers of solid masonry	A-1, A-2 or B
Piers of hollow units	A-1 or A-2
Walls of solid masonry	A-1, A-2, B or C
Walls of solid masonry, other than parapet walls or rubble stone walls, not less than 12 inches thick nor more than 35 feet in height, supported laterally at intervals, not exceeding 12 times the wall thickness	A-1, A-2, B, C or D
Walls of hollow units; load-bearing or exterior, and hollow walls 12 inches or more in thickness	A-1, A-2 or B
Hollow walls, less than 12 inches in thickness where assumed design wind pressure:	
(a) exceeds 20 pounds per square foot	A-1 or A-2
(b) does not exceed 20 pounds per square foot	A-1, A-2 or B
Non-bearing partitions or fireproofing composed of structural clay tile or concrete masonry units	A-1, A-2, B, C or gypsum
Gypsum partition tile or block	Gypsum
Fire brick	Refractory air setting mortar
Linings of existing masonry, either above or below grade	A-1 or A-2
Masonry other than above including fire walls	A-1, A-2 or B

909.4. Working stresses.

(a) Stresses shall be calculated on actual dimensions and not nominal dimensions.

(b) The allowable compressive stress in pounds per square inch of gross cross-sectional area shall not exceed the following limits:

Solid masonry of brick and other solid units of clay or shale; sand-lime or concrete brick:

Grade of Unit in lb. per sq. in.	Type A-1	Type A-2	Mortar		
			Type B	Type C	Type D
8000 plus	400	350	300	200	100
4500-8000	250	225	200	150	100
2500-4500	175	160	140	110	75
1500-2500	125	115	100	75	50

Grouted solid masonry of brick and other solid units of clay or shale; sand-lime or concrete brick:

Grade of Unit in lb. per sq. in.	Type A-1	Mortar		Type B
		Type A-2	Type C	
4500 plus	350	275	200	200
2500-4500	275	215	155	155
1500-2500	225	175	125	125

Solid masonry of solid concrete masonry units:

Grade of Unit in lb. per sq. in.	Type A-1	Mortar		Type C
		Type A-2	Type B	
1800 or higher	175	160	140	100
1200-1800	125	115	100	75

Masonry of hollow units:

Type A-1 Mortar	85
Type A-2 Mortar	75
Type B Mortar	70

Piers of hollow units, cellular spaces filled with concrete or either Type A-1 or A-2 mortar:

Type A-1 Mortar	105
Type A-2 Mortar	95
Type B Mortar	90

Cavity or masonry bonded hollow walls:

Stress on gross cross-sectional area of wall minus area of cavity:

Solid Units Grade in lb. per sq. in.	Type A-1	Mortar	
		Type A-2	Type B
2500 plus	140	130	110
1500-2500	100	90	80

Hollow Units		
Type A-1 Mortar	.....	70
Type A-2 Mortar	.....	60
Type B Mortar	.....	55

When the two wythes of hollow walls are evenly loaded the allowable stresses may be increased by 25 per cent.

Stone ashlar masonry:

Material	Mortar			
	Type A-1	Type A-2	Type B	Type C
Granite	800	720	640	500
Limestone	500	450	400	325
Marble	500	450	400	325
Sandstone	400	360	320	250
Cast Stone	400	360	320	250
Rubble Stone	140	120	100	80

Plain Concrete. The allowable compressive stress on plain concrete shall not exceed 25 per cent of the ultimate compressive strength of the concrete where the ratio of height to thickness does not exceed 10. For hollow walls of plain concrete, the allowable stress shall not exceed 20 per cent of the ultimate compressive strength of the concrete based upon the gross cross-sectional area of wall minus area of cavity.

(c) In walls veneered with stone, architectural terra cotta or other approved facing material, only the backing shall be assumed to take load and the working stress in such backing shall be taken as that prescribed for the type of masonry used as backing. Veneers shall not be considered a part of the required thickness of walls.

(d) In walls composed of different kinds or grades of units or mortar the maximum stress shall not exceed the allowable stress for the weakest of the units and mortar of which the wall is composed.

(e) Reinforced masonry. The stresses permitted in reinforced masonry shall meet with the approval of the building official and the design and details shall conform to the latest authoritative methods of engineering practice.

909.5. Solid masonry walls, except stone walls.

(a) Thickness of bearing walls.

(1) The thickness of solid masonry bearing walls shall be sufficient at all points to keep the combined stresses due to live, dead, and other loads for which the building is designed within the limits prescribed in section 909.4.

(2) Except as otherwise provided in paragraphs (3) to (6) below, the minimum thickness of solid masonry bearing walls shall be not less than 12 inches for the uppermost 35 feet of their height, and shall be increased 4 inches for each successive 35 feet or fraction thereof measured downward from the top of the wall.

(3) Where solid masonry bearing walls are stiffened at distances not greater than 12 feet apart by masonry cross walls, or by reinforced concrete floors or roof, they may be 12 inches thick for the uppermost 70 feet, measured downward from the top of the wall, and shall be increased 4 inches in thickness for each successive 70 feet or fraction thereof.

(4) In buildings of residential occupancy not more than 3 stories in height, solid masonry bearing walls may be 8 inches thick when not over 35 feet in height. Walls in one-story buildings of residential occupancy and one-story private garages may be 6 inches thick when not over 9 feet in height, except that the height to the peak of a gable may be 15 feet.

(5) The top story bearing wall of a building which does not exceed 35 feet in height may be 8 inches thick provided the top story bearing wall is not over 12 feet in height and the roof construction imparts no lateral thrust to the walls.

(6) Solid masonry bearing walls above roof level, 12 feet or less in height, enclosing penthouses or roof structures may be 8 inches thick and may be considered as neither increasing the height nor requiring any increase in the thickness of the wall below, provided the requirements for allowable stresses are complied with.

(b) Thickness of non-bearing exterior walls. Non-bearing exterior walls, except panel walls complying with section 911, may be 4 inches less in thickness than required for bearing walls, but the thickness shall be not less than 8 inches except where 6-inch walls are specifically permitted.

(c) Lateral support. Solid masonry walls shall be supported at right angles to the wall face at intervals not exceeding 20 times the nominal wall thickness if laid in Type A-1, A-2, B, or C mortar, and not exceeding 12 times the nominal wall thickness if laid in Type D mortar. Such lateral support shall conform to section 909.14.

(d) Bond. The facing and backing of solid masonry bearing and non-bearing walls shall be bonded as follows:

(1) The facing and backing shall be bonded so that not less than 4 per cent of the wall surface of each face is composed of headers extending not less than 4 inches into the backing. The distance between adjacent full length headers shall not exceed 24 inches either vertically or horizontally. In solid masonry walls in which a single header does not extend through the wall, headers from the opposite sides shall overlap at least 4 inches, or headers from opposite sides shall be covered with another header course overlapping the header below at least 4 inches; or

(2) The facing and backing shall be bonded with corrosion-resistant metal ties conforming to section 909.8(d)(2) for cavity walls. There shall be not less than one metal tie for each $4\frac{1}{2}$

square feet of wall area. Ties shall be staggered in alternate courses and spaced not farther apart than 18 inches vertically and 36 inches horizontally. Walls bonded with metal ties shall conform to the allowable stress, lateral support, thickness excluding cavity, height and mortar requirements for cavity walls in section 909.8.

909.6. Stone walls.

(a) Thickness.

(1) The thickness of stone walls shall be sufficient at all points to keep the combined stresses due to live, dead, and other loads for which the building is designed within the limits prescribed in section 909.4.

(2) The minimum thickness of walls of stone ashlar shall be not less than that required for solid masonry walls in section 909.5.

(3) Rubble stone walls shall be 4 inches thicker than is required for solid masonry walls in section 909.5, but shall not be less than 16 inches thick, and shall not exceed 40 feet in height.

(b) Lateral support. Stone walls shall conform to the requirements for lateral support of solid masonry walls in section 909.5(c) and section 909.14.

(c) Bond.

(1) In ashlar masonry, bond stones uniformly distributed shall be provided to the extent of not less than 10 per cent of the area of exposed faces and having not less than 4 inches of bond into the backing masonry.

(2) Rubble stone masonry 24 inches or less in thickness shall have bond stones with a maximum spacing of 3 feet vertically and horizontally, and if the masonry is of greater thickness than 24 inches shall have one bond stone for each 6 square feet of wall surface on both sides and no header stone shall be less than 12 inches long measured at right angles to the face of the masonry.

(d) Natural beds. All stones showing pronounced cleavage shall be laid on their natural bed, except for cornices and other projecting members which shall have the grain or bedding planes vertical and at right angles to the face of the masonry.

909.7. Walls of hollow masonry units.

(a) Thickness and height.

(1) The thickness of walls of hollow masonry units shall be sufficient at all points to keep the combined stresses due to live, dead, and other loads for which the building is designed within the limits prescribed in section 909.4.

(2) The minimum thickness of walls of hollow masonry units shall be not less than that required for solid masonry walls in section 909.5.

(b) Lateral support. Walls of hollow masonry units shall be supported at right angles to the wall face at intervals not exceeding 18 times the nominal wall thickness. Such lateral support shall conform to section 909.14.

(c) Bond.

(1) Hollow masonry units shall have full mortar coverage of the face shells in both the horizontal and vertical joints.

(2) Where two or more hollow units are used to make up the thickness of a wall, the inner and outer courses shall be bonded at vertical intervals not exceeding 3 feet, by lapping at least 4 inches over the unit below or by lapping with units at least 50 per cent greater in thickness than the unit below at vertical intervals not exceeding 17 inches, or bonded with corrosion-resistant metal ties conforming to section 909.8(d)(2) staggered in alternate courses and spaced not farther apart than 18 inches vertically and 36 inches horizontally.

(3) Brick facing or lining (which does not include veneering) when used in hollow block walls shall be bonded to the backing in accordance with paragraph (d) of section 909.5.

(4) Where walls of hollow masonry units are decreased in thickness, a course of solid masonry shall be interposed between the wall below and the thinner wall above, or the hollow units in the top course of the thicker wall shall be filled solidly with mortar or masonry.

(d) Bearing: In walls and piers of hollow masonry units, suitable provision shall be made for proper bearing at the ends of all beams and at points of load concentration.

909.8. Cavity and masonry bonded hollow walls.

(a) Allowable stresses. In cavity walls and masonry bonded hollow walls the compressive stresses in pounds per square inch of gross cross-sectional area minus area of cavity between wythes shall be in conformity with section 909.4.

(b) Thickness and height.

(1) Cavity walls and masonry bonded hollow walls shall not exceed 35 feet in height. Cavity walls, exclusive of the cavity, and masonry bonded hollow walls shall be not less in thickness than required for solid masonry walls in section 909.5.

(2) In cavity walls, neither the facing nor backing shall be less than 4 inches in thickness and the cavity shall be not less than 2 inches nor more than 3 inches in width.

(c) Lateral support. Cavity walls and masonry bonded hollow walls shall be supported at right angles to the wall face at intervals not exceeding 18 times the wall thickness. For cavity walls the value for thickness shall be the sum of the nominal

thicknesses of the inner and outer wythes. Lateral support shall conform to section 909.14.

(b) Bond.

(1) In masonry bonded hollow walls the parts of same shall be bonded so that not less than 4 per cent of the wall surface of each face is composed of headers extending not less than 4 inches into the backing. The distance between adjacent full length headers shall not exceed 24 inches either vertically or horizontally. In walls in which a single header does not extend through the wall, headers from the opposite sides shall overlap at least 4 inches, or headers from opposite sides shall be covered with another header course overlapping the header below at least 4 inches.

(2) In cavity walls the facing and backing shall be securely tied together with suitable bonding ties of adequate strength. A 3/16-inch diameter steel rod or metal tie of equivalent stiffness coated with a corrosion resistant metal or other approved protective coating shall be used for each 4½ square feet of wall surface and placed as specified in section 909.7(c)(2). Where hollow masonry units are laid with the cells vertical, rectangular ties shall be used; in other walls the ends of ties shall be bent to 90 degree angles to provide hooks not less than 2 inches long. Ties shall be embedded in horizontal joints of facing and backing. Additional bonding ties shall be provided at all openings, spaced not more than 3 feet apart around the perimeter and within 12 inches of the opening. Cavity walls of plain concrete shall be reinforced as provided for solid walls of plain concrete in section 909.12.

(e) Bearing.

(1) In masonry bonded hollow walls or cavity walls suitable provision shall be made at each line of floor beams and wherever load concentrations occur, to insure proper bearing.

(2) When cavity walls or masonry bonded hollow walls, in which the cells of hollow units are laid vertical, are decreased in thickness, the units in the top course of the thicker wall shall be filled solidly with mortar or masonry or the exposed openings in such top course shall be covered with slabs of hard burned tile or concrete at least one inch in thickness or the openings shall be stopped in some other approved manner.

(f) Drainage. In cavity walls the cavity shall be kept clear of mortar droppings during construction. Approved flashing shall be installed in hollow walls and adequate drainage provided to keep dampness away from the backing.

909.9. Grouted masonry.

(a) Material. In grouted masonry, masonry units used in either the facing or backing, but not necessarily both, at the time of laying, shall absorb in 24 hours of cold immersion an amount

of water weighing at least five per cent of the dry weight of the unit.

(b) Construction. All masonry units in the outer wythes shall be laid with full head and bed joints of Type A-1 or A-2 mortar and all interior joints shall be filled with grout. Masonry units in the interior wythes shall be placed or floated in grout poured between the two outer wythes. One of the outer wythes may be carried up not more than three courses before grouting but the other shall be carried up not more than one course above the grout. Each pour of grout shall be stopped at least $1\frac{1}{2}$ inches below the top and properly stirred. The grouted longitudinal vertical joints shall be not less than $\frac{3}{4}$ inch wide. Bonders shall not be used.

909.10. Faced walls.

(a) Material. The actual thickness of materials used for facing shall be not less than 2 inches, and in no case less in thickness than $\frac{1}{8}$ the height of the unit.

(b) Allowable stresses. Where bonded to the backing as prescribed in (e) below, the full cross section of both the facing and the backing may be considered in computing the stresses.

(c) Height and lateral support. Neither the height of faced walls nor the distance between supports shall exceed that prescribed for masonry of either of the types forming the facing or the backing.

(d) Thickness. Faced walls shall be not less in thickness than is required for masonry walls of either of the types forming the facing and the backing. Where bonded to the backing as prescribed in (e) below, the facing may be considered a part of the wall thickness.

(e) Bond.

(1) Brick facing shall be bonded to the backing as prescribed for solid masonry walls in section 909.5(d).

(2) Ashlar facing of either natural or cast stone shall have at least 10 per cent of the face area of the wall extending not less than 4 inches into the backing to form bond stones, which shall be uniformly distributed throughout the wall.

(3) When walls of hollow masonry units are faced with hollow units, the facing units shall be bonded to the backing as required for walls of hollow masonry units in section 909.7(c).

909.11. Attachment of stone facing.

Every bonding stone, and, except when alternate courses are full bond courses, every stone not a bond stone shall be securely anchored to the backing with corrosion resistant metal anchors with a cross section of not less than $\frac{3}{16}$ inch by one inch or its equivalent in cross-sectional area. There shall be at least 1 anchor to each stone and not less than 2 anchors for each stone more

than 2 feet in length and 3 square feet in face area; facing stones of greater size shall have at least 1 anchor to each 4 square feet of face area of the unit as applied but not less than 2 anchors.

909.12. Solid walls of plain concrete.

(a) Thickness.

(1) The thickness of walls of plain concrete shall be sufficient at all points to keep the combined stresses due to live, dead, and other loads for which the building is designed within the limits prescribed in section 909.4.

(2) The minimum thickness of walls of plain concrete may be 2 inches less than that required for solid masonry walls, but not less than 8 inches, except that 6-inch walls may be used where specifically permitted by section 909.5(a)(4).

(b) Lateral support. Solid walls of plain concrete shall be supported at right angles to the wall face at intervals not exceeding 20 times the nominal wall thickness. Such lateral support shall conform to section 909.14.

(c) Plain concrete. Plain concrete construction shall conform with nationally recognized good practice on matters not covered in this code.

(d) Reinforcement around openings. Reinforcement symmetrically disposed in the thickness of the wall shall be placed not less than 1 inch above and 2 inches below openings and extend not less than 24 inches each side of such openings or be of equivalent developed length with hooks. The reinforcement both above and below shall consist of one $\frac{5}{8}$ -inch round rod for each 6 inches in wall thickness or fraction thereof, or the equivalent.

909.13. Reinforced masonry.

Reinforced masonry of less thickness and without the lateral support specified for solid masonry may be used when approved by the building official.

909.14. Lateral support.

The lateral support required by sections 909.5, 909.6, 909.7, 909.8 and 909.12 shall be either vertical or horizontal but not necessarily both. It may be obtained by cross walls, piers, or buttresses, when the limiting distance is measured horizontally, or by floors and roofs when the limiting distance is measured vertically. Sufficient bonding or anchorage shall be provided between the walls and the supports to resist the assumed wind or other horizontal force, acting either inward or outward. Piers, buttresses and cross walls relied upon for lateral support shall have sufficient strength and stability to transfer the horizontal force, acting in either direction to adjacent structural members or to the ground. When walls are dependent upon floors or roofs for their lateral support, provision shall be made in the building to transfer the lateral forces to the ground.

SECTION 910. GLASS BLOCK MASONRY.**910.1. Thickness.**

Glass block masonry used in non-bearing portions of exterior or interior walls, shall have a minimum overall thickness at the mortar joint of at least $3\frac{1}{2}$ inches and all mortar surfaces shall have satisfactory treatment for mortar bonding properties.

910.2. Area permitted.

(a) Glass block panels in exterior walls shall not exceed 144 square feet of unsupported wall surface nor 25 feet in length nor 20 feet in height between mullions or other suitable supports. Glass block panels in interior walls or partitions shall not exceed 250 square feet of unsupported area nor 25 feet in any direction between such supports.

(b) Glass block panels when used as window protectives in accordance with section 803 shall not exceed 120 square feet in area nor 12 feet in width or height and shall have reinforcement in every horizontal mortar joint, except between the two top rows.

910.3. Construction.

(a) Glass blocks shall be laid in Type A-1, A-2 or B mortar. All mortar joints shall be completely filled and shall have a thickness of at least $\frac{1}{4}$ -inch and not more than $\frac{3}{8}$ -inch.

(b) Horizontal mortar joints shall be reinforced with ties which shall run continuously from end to end of mortar joint, but must not "bridge" expansion joints. Where splices occur the individual lengths shall be lapped not less than 6 inches. The reinforcement shall be spaced not more than 2 feet apart vertically and shall be placed in the joint immediately below and above any openings within a panel.

(c) Reinforcement shall consist of two parallel longitudinal galvanized steel wires, No. 9 gauge or larger, spaced 2 inches apart, and having welded thereto No. 14 gauge or heavier cross wires at intervals not exceeding 8 inches, or the approved equivalent.

(d) Exterior glass block panels shall be held in place in the wall opening to resist both external and internal pressures due to wind. Panels shall be set in recesses at the jambs and, for panels exceeding 10 feet in horizontal dimension between supports, at the head as well, so as to provide a bearing surface at least one inch wide along the panel edges; except that the building official may approve anchorage by means of corrosion resistant perforated metal strips for panels not larger than 100 square feet in area with no dimension greater than 10 feet and located at a height not over 4 stories or 52 feet above grade.

(e) Exterior glass block panels shall be provided with expansion joints at the sides and top. Such joints shall be entirely free of mortar, and shall be filled with resilient material.

(f) Where glass blocks are used as veneer in masonry construction, the glass block panels shall be self-supporting, with suitable ties into the masonry wall, and shall be clear from and not adhering to the masonry.

SECTION 911. MASONRY PANEL WALLS.

911.1. Thickness.

Panel walls of masonry except fire walls, not exceeding 13 feet in height between supports shall not be limited in thickness provided they have the required fire resistance rating and have sufficient strength to withstand imposed loads.

911.2. Anchorage.

All panel walls shall be adequately anchored to the structural frame in an approved manner.

SECTION 912. MASONRY NON-BEARING PARTITION CONSTRUCTION.

(a) The distance between lateral supports of non-bearing partitions of masonry shall not exceed 36 times the actual thickness of the partition including plaster. Such lateral support may be obtained by cross walls, piers, or buttresses, when the limiting distance is measured horizontally, or by floors and roofs when the limiting distance is measured vertically.

(b) If the partition depends upon a ceiling, floor or roof for lateral support the partition shall be securely anchored thereto.

SECTION 913. REINFORCED CONCRETE.

913.1. General.

Reinforced concrete construction shall conform with nationally recognized good practice on matters not covered in this code.

913.2. Working stresses.

(a) Except under the specific conditions given in paragraph (b) below, design stresses shall not exceed the following:

	Lbs. per sq. in.
Extreme fiber of concrete in compression	900
Concrete in direct compression	500
Concrete in shear	60

	Lbs. per sq. in.
Concrete in shear when diagonal tension is resisted by properly designed steel	240
Bond between concrete and steel	60
Bond between concrete and approved deformed bars	140
Steel in tension, structural grade	18,000
Steel in tension, intermediate or hard grade or rail steel	20,000
Cold drawn steel wire in tension	20,000

(b) When evidence satisfactory to the building official is submitted that controlled concrete of a predetermined strength is to be used and that the design and construction will be under competent supervision, higher stresses than those given in paragraph (a) of this section may be used in accordance with nationally recognized good practice.

(c) For members carrying wind stresses only, and for combined stresses due to wind and other loads, the working stresses prescribed above may be increased $33\frac{1}{3}$ per cent; provided the section thus found is not less than required by the dead load and live loads alone.

913.3. Concrete.

(a) Average concrete for reinforced concrete shall consist of 1 part portland cement and not more than 6 parts aggregate, by volume measured dry, and not more than $7\frac{1}{2}$ gallons of water per sack, 94 pounds, of cement. The aggregate shall be mixed in an approximate ratio of $2\frac{1}{2}$ parts fine aggregate and $3\frac{1}{2}$ parts coarse aggregate.

(b) Fine and coarse aggregate shall consist of clean, hard, durable, uncoated particles free from deleterious materials and shall conform with nationally recognized good practice. The maximum size of the aggregate shall be not larger than $\frac{1}{5}$ the narrowest dimension between forms nor larger than $\frac{3}{4}$ the minimum clear spacing between reinforcing bars.

(c) Controlled concrete for reinforced concrete shall be scientifically proportioned to meet the specific requirements imposed, and the materials and mixture and placing shall be subjected to tests to determine fitness and proper mixtures.

(d) Concrete shall be deposited as a continuous operation in the final position to avoid segregation of the aggregate due to handling or flowing. It shall be placed at such a rate that the concrete is at all times plastic and flows readily into spaces between the reinforcement and be thoroughly compacted by suitable means.

913.4. Reinforcement.

(a) The steel reinforcement shall conform to nationally recognized good practice.

(b) Expanded metal lath, steel wire or fabric for the reinforcement of slabs, for lateral reinforcement of columns, or for resistance to shrinkage and temperature stresses may be used.

913.5. Protection of reinforcement.

(a) The reinforcement of footings and other principal structural members in which the concrete is deposited against the ground shall have not less than 3 inches of concrete between it and the ground contact surface. If concrete surfaces after removal of the forms are to be exposed to the weather or be in contact with the ground, the reinforcement shall be protected with not less than 2 inches of concrete for bars more than $\frac{5}{8}$ -inch in diameter and $1\frac{1}{2}$ inches for bars $\frac{5}{8}$ -inch or less in diameter.

(b) The concrete protective covering for reinforcement at surfaces not exposed directly to the ground or weather shall conform to the minimum thicknesses as follows:

For columns, beams and girders $1\frac{1}{2}$ inches

For solid slabs, walls and concrete joist floors where distance between joists is 30 inches or less $\frac{3}{4}$ -inch

(c) Concrete protection for reinforcement shall in all cases be at least equal to the diameter of round bars and $1\frac{1}{2}$ times the side dimension of square bars.

(d) Where greater thicknesses of concrete protection of reinforcement are required to comply with fire resistance rating requirements, then such greater thicknesses shall be used.

913.6. Protection against freezing.

(a) No concrete shall be placed in forms when the surrounding air temperature is below 40 degrees Fahrenheit unless the temperature of the concrete when placed in the forms is between 60 and 90 degrees Fahrenheit and is maintained at a temperature of not less than 50 degrees Fahrenheit for at least 24 hours for high-early-strength concrete and at least 72 hours for normal concrete. The housing, covering or other protection used in connection with curing shall remain in place and intact for at least 24 hours for high-early-strength concrete and at least 72 hours for normal concrete. The housing, covering or other protection used in connection with curing shall remain in place and intact for at least 24 hours after the artificial heating is discontinued.

(b) No dependence shall be placed on salt or other chemicals for the prevention of freezing of concrete.

913.7. Walls.

(a) Reinforced concrete walls shall be securely anchored to the floors, columns, piers, pilasters, buttresses and intersecting walls.

(b) The thickness of bearing walls of reinforced concrete shall be not less than 6 inches for the uppermost 15 feet of their height and shall increase 1 inch for each successive 25 feet or fraction thereof measured downward from the top of the wall. In dwellings two stories or less in height, the walls may be 6 inches throughout. In no case shall the thickness be less than $1/25$ of the unsupported height or width, whichever is the shorter.

(c) Panel walls shall be not less than 5 inches in thickness and in no case less than $1/30$ the unsupported height or width, whichever is the shorter.

(d) The steel reinforcement shall be not less in each direction than 0.0025 times the cross sectional area of the wall if of bars and 0.0018 times such area if of electrically welded wire fabric. In walls more than 10 inches in thickness the reinforcement for each direction shall be placed in 2 layers. One layer consisting of from $1/2$ to $2/3$ of the total required shall be placed not less than 2 inches nor more than $1/3$ the thickness of the wall from the exterior surface and the remainder of the reinforcement shall be placed not less than $3/4$ -inch and not more than $1/3$ the thickness of the wall from the interior surface. Electrically welded fabric of proper gauge shall be placed in conformity with nationally recognized good practice.

(e) Proper reinforcement shall be provided around all openings in a reinforced concrete wall.

913.8. Forms.

Forms for reinforced concrete shall be properly designed to support the loads imposed thereon and shall remain in place until the concrete has hardened. Removable floor forms, beam and girder sides, column casings and other vertical parts of forms, shall not be removed until the concrete has set sufficiently that it will not be injured by their removal. Those parts of the forms and shoring that support structural members shall not be removed until such members have acquired sufficient strength to support safely their own weight and such loads as may come upon them.

SECTION 914. REINFORCED GYPSUM CONCRETE.

914.1. General.

(a) Reinforced gypsum concrete construction shall conform with nationally recognized good practice on matters not covered in this code.

(b) Gypsum concrete shall not be used where exposed directly to the weather or where subjected to frequent or continuous wetting. Precautions shall be taken against saturation and freezing during construction.

914.2. Gypsum concrete.

(a) Gypsum concrete shall consist of a mixture of gypsum and water, with or without chips, shavings or fiber or other approved aggregate. The gypsum and wood chips, shavings or fiber shall be premixed at the mill, requiring the addition of water only at the place of use.

(b) Poured gypsum concrete shall conform with nationally recognized good practice.

(c) Precast gypsum concrete shall contain not more than 3 per cent of wood chips, shavings or fiber measured as a percentage by weight of the dry mix.

(d) Wood chips, shavings or fiber used in gypsum concrete shall be dry, soft wood, uniform and clean in appearance. They shall pass a one-inch screen and shall be not more than 1/16-inch in thickness.

914.3. Reinforcement.

(a) The steel reinforcement shall conform with nationally recognized good practice for concrete reinforcement.

(b) Reinforcing fabric shall be galvanized, welded wire fabric having an effective cross sectional area of not less than 0.026 square inches per foot of width, equivalent to No. 12 gauge longitudinal wires spaced not more than 4 inches on centers and transverse wires shall be equivalent to No. 14 gauge wires and shall be spaced not more than 8 inches on centers.

914.4. Design.

(a) Gypsum concrete shall be classed according to mixture, and concrete of each class shall develop a minimum strength in compression as follows:

Poured gypsum concrete:

Class A	500 p.s.i.
Class B	1000 p.s.i.

Precast gypsum concrete:

Class 1. Neat (containing gypsum and water only)	1800 p.s.i.
Class 2. Containing not more than 3 per cent by weight of wood chips, shavings or fiber	1000 p.s.i.

(b) In the design of floor and roof slabs of reinforced gypsum concrete, the following values shall be used for the modulus of elasticity for the several classes of gypsum concrete.

Poured gypsum concrete:

Class A	200,000 p.s.i.
Class B	600,000 p.s.i.

Precast gypsum concrete:

Class 1.	1,000,000 p.s.i.
Class 2.	600,000 p.s.i.

(c) In the design of reinforced gypsum concrete the stresses in the concrete shall not exceed the values shown in the following table where f_g equals the compressive strength of the concrete mixture as determined in accordance with this section.

Compressive stress in bending	0.25 f_g
Axial compressive or bearing stress	0.20 f_g
Bond stress	0.02 f_g See Note (a)
Shearing stress	0.02 f_g See Note (a)

Note (a) Gypsum concrete reinforced with electrically welded wire fabric meeting the requirements of section 914.3 meets the bond and shear requirements of this paragraph.

The working stresses in reinforcing steel shall conform with the following:

Design stress of steel sub-purlins in tension shall not exceed the minimum yield strength of the steel divided by 1.85.

Design stress of wires or wire fabric shall not exceed 50 per cent of the minimum yield point of the steel used and in no case shall it exceed 25,000 pounds per square inch.

914.5. Minimum thickness.

(a) The minimum thickness of gypsum concrete used structurally shall be 2 inches except in the suspension system where it shall be not less than 3 inches. Hollow precast gypsum concrete units for roof construction shall be not less than 3 inches thick and the shell not less than $\frac{1}{2}$ -inch thick.

(b) Where greater thicknesses of gypsum concrete are required to comply with fire resistance rating requirements, then such greater thicknesses shall be used.

914.6. Precast gypsum concrete units.

Precast gypsum concrete units for floor or roof construction shall be reinforced and, unless the shape or marking of the unit is such as to insure its being placed right side up, the reinforcement shall be placed symmetrically so that the unit can support its load either side up.

SECTION 915. CHASES AND RECESSES.

(a) No chase shall extend into a wall more than $\frac{1}{3}$ of its thickness; but no chase shall be cut or built in an 8-inch wall or

within the required area of a pier, except that in buildings of residential occupancy not more than 2 stories high, chases not more than 4 inches deep and not more than 4 square feet of wall area may be built in an 8-inch wall. Recesses below windows may extend from floor to sill and be the width of the opening above.

(b) No horizontal chase shall exceed 4 feet in length, nor shall the horizontal projection of any diagonal chase exceed 4 feet.

(c) Chases shall not be cut in hollow walls or walls of hollow units, but, when permitted, shall be built in.

(d) Chases shall be filled in solidly with noncombustible material within the floor thickness at each floor level.

(e) Recesses for stairways or elevators may be left in walls of buildings, but the thickness of the wall at such recesses shall be not less than 12 inches, unless reinforced by additional piers, by steel or reinforced concrete girders, or by steel or reinforced concrete columns and girders, securely anchored to walls on each side of such recesses. Recesses for alcoves and similar purposes shall have not less than 8 inches of material at the back. Such recesses shall be not more than 8 feet in width and shall be arched over or spanned with lintels.

(f) The aggregate area of chases and recesses in a wall shall not exceed $\frac{1}{4}$ of the whole area of the face of the wall in any story.

(g) Chases or recesses that would reduce the thickness below the required minimum, shall not be built or cut in fire walls.

SECTION 916. STRUCTURAL STEEL AND CAST IRON.

916.1. General.

The design, fabrication and erection of structural steel and cast iron shall conform with nationally recognized good practice on matters not covered in this code.

916.2. Structural steel.

Structural steel shall conform with nationally recognized good practice. Unidentified stock material, if free from surface imperfections, may be used for short sections of minor importance, or for small unimportant details, where the precise physical properties of the material would not affect the safety of the structure.

916.3. Working stresses for structural steel.

(a) The working stresses, in pounds per square inch, in structural steel shall not exceed the following:

	Lbs. per sq. in.
Tension, net section	20,000
Compression in columns, maximum	17,000
Extreme fiber stress in flexure, in tension	20,000
Extreme fiber stress in pins	30,000
Shear in webs of beams and plate girders, maximum	13,000
Shear in rivets, pins, properly tightened high strength bolts in ordinary holes, and turned bolts in reamed or drilled holes	15,000
Bearing on pins and power-driven rivets in single shear	32,000
Power-driven rivets in double shear and turned bolts in reamed or drilled holes	40,000

(b) The working stress for columns proportioned for combined axial and bending stresses and for fully continuous beams and girders may be increased in accordance with nationally recognized good practice.

(c) The working stresses for structural steel columns and struts shall vary with the ratio of unsupported length to least radius of gyration of the section, in accordance with nationally recognized good practice. For main compression members subjected to stress due to dead loads or live loads, the ratio of 120 shall not be exceeded, except as provided by nationally recognized good practice; for bracing and other secondary members in compression the ratio of 200 shall not be exceeded.

(d) In laterally unsupported structural steel members, the compressive working stress in flanges of beams and girders shall be reduced in accordance with nationally recognized good practice.

(e) Welded joints constructed with base material and filler metal of prescribed quality shall be proportioned so that the stresses caused therein by the imposed loads shall not exceed the following values:

- Shear on section through throat of fillet weld, or on faying surface area of filled plug or slot weld 13,600 lbs. per sq. in.
- Tension on section through throat of butt weld—use corresponding allowable stress for base metal.
- Compression or shear on section through throat of butt weld—use corresponding allowable stress for base metal.

Fiber stresses in butt welds due to bending shall not exceed the values prescribed above for tension and compression, respectively.

Stress in a fillet weld shall be considered as shear on the throat, for any direction of the applied stress.

Plug or slot welds shall not be ascribed any value in resistance to stresses other than shear.

In rivets, bolts and welds subjected to both shear and bending stresses, the maximum unit stress resulting from the combination shall not exceed the above specified stress for shear.

Rivets or bolts in combination with welds shall not be considered as sharing the stress, and welds shall be provided to carry the entire stress for which the connection is designed.

(f) For members carrying wind stresses only, and for combined stresses due to wind and other loads, the working stresses prescribed above may be increased $33\frac{1}{3}$ per cent; provided the section thus found is not less than required by the dead load and live loads alone.

916.4. Working stresses for cast iron.

(a) The working stresses, in pounds per square inch, in cast iron, shall not exceed the following:

	Lbs. per sq. in.
Direct compression on short blocks	9,000
Extreme fiber stress in compression	16,000
Extreme fiber stress in tension	3,000
Shear	3,000

(b) The working stresses, in pounds per square inch of cross section, for hollow cast iron columns shall vary with the ratio of unsupported length to least radius of gyration of the section, as follows:

Ratio	Lbs. per sq. in.	Ratio	Lbs. per sq. in.
70.....	6,200	30.....	7,800
60.....	6,600	20.....	8,200
50.....	7,000	10.....	8,600
40.....	7,400		

For intermediate ratios the working stresses shall be proportionate to those given. The maximum ratio here given shall not be exceeded.

(c) Cast iron columns shall not be subjected to tensile stresses.

916.5. Cast iron columns.

(a) Cast iron columns shall not have a smaller outside diameter or side than 5 inches.

(b) The thickness of metal shall be not less than $\frac{1}{12}$ the diameter or least dimension of cross section, but not less than $\frac{3}{4}$ of an inch.

(c) Cast iron columns not cast with one open side or back, shall have $\frac{3}{8}$ -inch holes drilled in the shaft, to permit measurement of the thickness.

916.6. Minimum thickness of structural steel.

The minimum thickness of exterior structural steel enclosed in a non-impervious envelope or exposed to frequent rain or snow, and of interior structural steel subject to an atmospheric exposure more corrosive than an indoor atmosphere controlled for human comfort shall be not less than:

- (1) $\frac{1}{4}$ -inch for columns, studs, lintels, girders, beams, exterior trusses and exterior bracing members.
- (2) $\frac{3}{16}$ -inch for purlins, girts, trusses and bracing members sheltered from direct exposure to rain and snow.

916.7. Column bases.

(a) Proper provision shall be made to transfer the column loads, and moments, if any, to the footings and foundations.

(b) Cast iron bases or shoes shall be not less than one inch thick in any part and they shall be planed on top, and, when resting on steel girders, on both top and bottom.

(c) Rolled steel bearing plates shall be finished in conformity with nationally recognized good practice.

(d) Columns shall be securely anchored to their foundations.

916.8. Lintels, box beams and girders.

(a) Cast iron lintels shall not be used for spans exceeding 6 feet. They shall be not less than $\frac{3}{4}$ of an inch in thickness at any point.

(b) When two or more rolled beams or channels are used to form a girder, they shall be connected by bolts or separators at intervals of not more than 5 feet. All beams having a depth of 12 inches or more shall have at least 2 bolts to each separator. When concentrated loads are carried from one beam to the other, or distributed between the beams, diaphragms shall be used, designed with sufficient stiffness to distribute the load. Where beams are exposed, they shall be sealed against corrosion of interior surfaces or spaced sufficiently far apart to permit cleaning and painting.

(c) The thickness of web in plate girders shall be not less than $\frac{1}{170}$ of the unsupported distance between flanges.

916.9. Assembling.

(a) Except where unfinished bolts are permitted, all work shall be riveted, welded, or assembled by means of properly tightened high strength bolts in ordinary punched or drilled holes, or by means of turned bolts in reamed or matched drilled holes conforming to accepted practice.

(b) Riveting, welding, high strength bolts, or turned bolts shall be used for the connections of main members carrying live loads which produce impact and for connections subject to reversal of stresses.

916.10. Welding.

(a) Surfaces to be welded shall be free from loose scale, slag, rust, paint, grease or other foreign matter.

(b) Surfaces which are to be welded after erection preferably shall not receive any shop paint. If painted before erection, paint on surfaces adjacent to joints to be welded shall be thoroughly removed to expose clean steel for a distance of at least two inches from either side of the joint.

(c) Steel construction which is to be welded shall be held in the correct position by bolts, clamps, wedges, guy lines, struts or other suitable devices or by tack welds until welding has been completed.

(d) Arc and gas welding shall conform with nationally recognized good practice on matters not covered in this code. Safeguards used in connection with welding and gas cutting shall comply with section 1212.

916.11. Arc or gas cutting.

(a) Nothing in this code shall prohibit arc or gas cutting in steel construction; provided that arc or gas cutting shall not be done on a member while it is under substantial stress.

(b) Cut edges shall be smooth and regular in contour, and when used in the preparation of base metal parts for welding, special care shall be taken to assure a surface suitable for welding.

(c) Cutting of holes in a member which has not been designed therefor shall not be done.

916.12. Tie rods.

(a) Tie rods when used shall be designed to withstand the stresses to which they will be subjected.

(b) Holes for tie rods in floor arches shall be placed as near the thrust of the arch as practicable.

916.13. Anchorage and bearing.

Lintels, steel joists, beams, girders or trusses, supported at either end by a wall or pier, shall be properly anchored thereto and shall rest upon bearing plates or shoes of cast iron, steel or stone of such design and dimensions to distribute safely the loads on the masonry, unless the bearing surface of the lintels, steel joists or beams is sufficient to distribute the load.

916.14. Protection against corrosion.

(a) Except for surfaces which are to be completely covered with cement grout or mortar or completely imbedded in concrete, or which are to be welded after erection, structural steel shall have at least one coat of paint suitable for the purpose before erection, and at least one coat of a different shade than the first, after erection.

(b) Cast iron columns shall not be painted until after inspection.

(c) All scale, dirt and rust shall be completely removed before painting iron or steel.

(d) Iron or steel used underground or underwater shall be covered on all sides by not less than 3 inches of concrete.

SECTION 917. LIGHT GAUGE STEEL STRUCTURAL MEMBERS.

(a) Light gauge steel construction shall conform with nationally recognized good practice on matters not covered in this code.

(b) The term light gauge steel structural members as used in this code refers to structural members cold formed to shape from sheet or strip steel less than 3/16-inch in thickness.

(c) The quality of light gauge steel for structural members shall conform with nationally recognized good practice.

(d) Light gauge steel construction shall be braced for any loads incident to construction as well as for the designed loads.

(e) Steel studs, panels, and other light gauge members used as framing in walls, floors and roofs shall be thoroughly cleaned and given at least one coat of paint or other approved protection before leaving the shop. When, in the opinion of the building official, this shop paint has deteriorated or the steel is rusty it shall be repainted.

SECTION 918. STEEL JOISTS.

918.1. General.

Steel joist construction shall conform with nationally recognized good practice on matters not covered in this code.

918.2. Material.

The quality of steel used in steel joist construction shall conform with nationally recognized good practice.

918.3. Design.

(a) Open web steel joists shall be designed as trusses, solid web steel joists as beams. Deck or top slabs over steel joists shall not be assumed to carry any part of the compression stress to be carried by the steel joists.

(b) The maximum tensile stress shall not exceed 18,000 pounds per square inch.

(c) Compression chords and diagonals of open web steel joists shall not have a ratio of length (clear distance between welds or attachments) to least radius of gyration in excess of 120, nor shall the unit compression stress exceed 15,000 pounds per square

inch, nor shall it exceed S as determined by the following formula, in which L is the length of the member and r is the least radius of gyration:

$$S = \frac{18,000}{1 + \frac{L^2}{18,000 r^2}}$$

(d) Joists and component parts of joists formed of flat-rolled strip or sheet steel shall be designed in accordance with section 916.

918.4. Fabrication.

(a) All joints of the members that comprise a steel joist shall be made by connecting the members directly to one another by fusion or resistance welds, or by rivets.

(b) In the case of expanded steel joists, a portion of the metal may be left intact to form a connection.

(c) In the case of nailer joists, wood nailer strips shall be firmly attached to the top chord of the joist. Such nailer strips shall be of good grade wood at least $1\frac{1}{2}$ inch x $1\frac{1}{2}$ inch in net section.

918.5. Anchorage.

(a) The ends of steel joists shall extend a distance of at least 4 inches onto masonry or reinforced concrete supports, and at least $2\frac{1}{2}$ inches on steel supports, but not less than that needed to obtain proper bearing area. Every third steel joist bearing on concrete or masonry supports shall be anchored thereto with an anchor equivalent to a $\frac{3}{8}$ -inch round steel rod. The ends of all steel joists supported on masonry walls shall be bedded in mortar.

(b) All steel joists supported on steel beams shall be secured thereto with an anchor made of not less than a $3/16$ -inch round bar fastened over the flanges of the supporting beams, or other equivalent approved attachment, except that in the case of buildings having a height of more than twice the least dimension of the base, each steel joist shall be welded, bolted or riveted to the supporting steel work.

918.6. Span.

The span of steel joists in steel joist construction shall not exceed 24 times the depth of the steel portion of the steel joist.

918.7. Bridging.

(a) As soon as steel joists have been erected and before application of construction loads, bridging shall be installed between them. This bridging shall be adequate to safely support the top

chords or flanges against lateral movement during the construction period and shall hold the steel joists in an approximately vertical plane passing through the bearings. The steel joists at the ends of panels shall be braced laterally by anchors or ties at each line of bridging.

(b) The number of lines of bridging shall be: one row, near the center, for spans up to 14 feet; two rows, approximately $\frac{1}{4}$ span apart and symmetrically located, for spans 14 to 21 feet; and 3 rows approximately equally spaced, for spans 21 to 32 feet.

(c) In the case of nailer steel joists carrying a wood deck, the wood deck may be used as the top member of the bridging system.

918.8. Decks or top slabs.

Decks or top slabs over steel joists may be of concrete or gypsum poured on metal lath centering or equally suitable permanent centering, or on removable centering, provided that top chords or flanges of the steel joists are stayed laterally by the top slab. Precast concrete top slabs, precast gypsum top slabs, wood decks, or steel decks shall be securely anchored to the top chords or flanges of the joists.

918.9. Protective coating.

All steel joists shall be given one coat of asphalt base paint or an equivalent approved protective covering, before leaving the shop. When, in the opinion of the building official, this shop paint has deteriorated or the steel has rusted, it shall be repainted.

SECTION 919. WOOD STRUCTURAL MEMBERS.

919.1. General.

Wood construction shall conform with nationally recognized good practice on matters not covered in this code.

919.2. Working stresses.

(a) Wood structural members shall be of sufficient size to carry the dead and required live loads without exceeding the allowable working stresses for the respective species and grade as given in table 919 or as approved by the building official in accordance with nationally recognized good practice in wood construction.

(b) The stresses used for any wood of a given species shall be the lowest stresses shown in the tables for that species unless the wood is identified by the grade mark of, or certificate of inspection issued by, a lumber grading or inspection agency approved by the building official.

(c) For members carrying wind stresses only, and for combined stresses due to wind and other loads, the working stresses given in this section may be increased $33\frac{1}{3}$ per cent; provided

TABLE 919a

WORKING STRESSES FOR JOISTS AND PLANKS, BEAMS AND STRINGERS, POSTS AND TIMBERS

The working stresses below are for normal loading conditions. See section 919.2 for permissible adjustments in working stresses for loads of other types, and for species and grades not given in the following table. The lowest stresses for each species are shown in *italics*.

1 Species and Commercial Grade ¹	2 Rules under which Graded	Allowable Unit Stresses in Pounds per Square Inch		
		3 Extreme fiber in bending "f" and tension parallel to grain ² "t"	4 Horizontal shear "H"	5 Compression perpendicular to grain "c" ³
DOUGLAS FIR, COAST REGION:				
Dense Select Structural ⁴	J.&P. ² —B.&S. ²	2150	145	455
Select Structural.....	J.&P. ² —B.&S. ²	1900	120	415
1700 f.—Dense No. 1 ⁴	J.&P. ² —B.&S. ²	1700	145	455
1450 f.—No. 1.....	J.&P. ² —B.&S. ²	1450	120	390
1100 f.—No. 2.....	J.&P. ²	1100	110	390
Dense Select Structural ⁴	P.&T.			455
Select Structural.....	P.&T.			415
Dense No. 1 ⁴	P.&T.			455
No. 1.....	P.&T.			390
DOUGLAS FIR, INLAND REGION:				
Select Structural ⁴	J.&P. ²	2150	145	455
Structural.....	J.&P. ²	1900	100	400
Common Structural.....	J.&P. ²	1450	95	380
Select Structural ⁴	P.&T.			455
Structural.....	P.&T.			400
Common Structural.....	P.&T.			380
HEMLOCK, EASTERN:				
Select Structural.....	J.&P. ² —B.&S. ²	1300	85	
Prime Structural.....	J.&P. ²⁻⁷	1200	60	
Common Structural.....	J.&P. ²⁻⁷	1100	60	360
Utility Structural.....	J.&P. ²⁻⁷	950	60	
Select Structural.....	P.&T.			
HEMLOCK, WEST COAST:				
1600 f.—Select Structural.....	J.&P. ²	1600	100	
1450 f.—No. 1.....	J.&P. ² —B.&S. ²	1450	100	360
1100 f.—No. 2.....	J.&P. ²	1100	90	
No. 1 Hemlock Timbers.....	P.&T.			
PINE, NORWAY:				
Prime Structural.....	J.&P. ²⁻⁷	1200	75	
Common Structural.....	J.&P. ²⁻⁷	1100	75	360
Utility Structural.....	J.&P. ²⁻⁷	950	75	
PINE, SOUTHERN LONGLEAF: ³				
Select Structural longleaf ⁴⁻⁵	J.&P.—B.&S.	2400	120 ⁶	
Prime Structural Longleaf ⁴⁻⁵	J.&P.—B.&S.	2000	120 ⁶	
Merchantable Structural Longleaf ⁴⁻⁵	J.&P.—B.&S.	1800	120 ⁶	
Structural S.E.&S. Longleaf ⁴	J.&P.—B.&S.	1800	120 ⁶	
No. 1 Structural Longleaf ⁴	J.&P.—B.&S.	1600	120 ⁶	
No. 1 Longleaf 1400f ⁹⁻⁵	J.&P.—B.&S.	1400	140	
No. 1 Longleaf ⁴	J.&P. ⁷	1700	150	
No. 2 Longleaf ⁴	J.&P. ⁷	1250	100	455
Select Structural Longleaf ⁴⁻⁵	P.&T.			
Prime Structural Longleaf ⁴⁻⁵	P.&T.			
Merchantable Structural Longleaf ⁴⁻⁵	P.&T.			
Structural S.E.&S. Longleaf ⁴	P.&T.			
No. 1 Structural Longleaf ⁴	P.&T.			
No. 1 Longleaf 1400f ⁹⁻⁵	P.&T.	1400	140	

TABLE 919a—Continued

WORKING STRESSES FOR JOISTS AND PLANKS, BEAMS AND STRINGERS, POSTS AND TIMBERS

The working stresses below are for normal loading conditions. See section 919.2 for permissible adjustments in working stresses for loads of other types, and for species and grades not given in this table. The lowest stresses for each species are shown in *italics*.

1 Species and Commercial Grade ¹	2 Rules under which Graded	Allowable Unit Stresses in Pounds per Square Inch		
		3 Extreme fiber in bending "f" and tension parallel to grain ² "t"	4 Horizontal shear "H"	5 Compression perpendicular to grain "c" ³
PINE, SOUTHERN: ³				
Dense Select Structural ⁴	J.&P.—B.&S.	2400	120 ⁶	455
Dense Structural ⁴	J.&P.—B.&S.	2000	120 ⁶	455
Dense Structural S.E.&S. ⁴	J.&P.—B.&S.	1800	120 ⁶	455
Dense No. 1 Structural ⁴	J.&P.—B.&S.	1600	120 ⁶	455
No. 1 Dense 1400f ⁷⁻⁵	J.&P.—B.&S.	1400	140	455
No. 1 Dense 1200f ⁹	J.&P.—B.&S.	1200	120	390
No. 1 Dense ⁴	J.&P. ⁷	1700	150	455
No. 1.....	J.&P. ⁷	1450	125	390
No. 2 Dense ⁴	J.&P. ⁷	1250	100	455
No. 2.....	J.&P. ⁷	1100	85	390
Dense Select Structural ⁴	P.&T. ....	.....	.....	455
Dense Structural ⁴	P.&T. ....	.....	.....	455
Dense Structural S.E.&S. ⁴	P.&T. ....	.....	.....	455
Dense No. 1 Structural ⁴	P.&T. ....	.....	.....	455
No. 1 Dense 1400f ⁷⁻⁵	P.&T.	1400	140	455
No. 1 Dense 1200f ⁹	P.&T.	1200	120	390
REDWOOD:				
Dense Structural ⁴	J.&P. ² —B.&S. ² ..	1700	110	320
Heart Structural.....	J.&P. ² —B.&S. ² ..	1300	95	.....
Dense Structural ⁴	P.&T. ....	.....	.....	.....
Heart Structural.....	P.&T. ....	.....	.....	.....
SPRUCE, EASTERN:				
1450 f Structural Grade.....	J.&P. ²	1450	110	.....
1300 f Structural Grade.....	J.&P. ²	1300	95	300
1200 f Structural Grade.....	J.&P. ²	1200	95	.....
TUPELO:				
1700 f Grade.....	J.&P.	1700	120	.....
1450 f Grade.....	J.&P.—B.&S.	1450	120	360
1200 f Grade.....	J.&P.—B.&S.	1200	120	.....
1075 c Grade.....	P.&T. ....	.....	.....	.....

¹ Abbreviations: J.&P., Joists and Planks; B.&S., Beams and Stringers; P.&T., Posts and Timbers; S.E.&S., Square Edge and Sound.

² When graded in accordance with par. 310 of Misc. Pub. 185 U. S. Dept. of Agr.

³ According to 1948 Standard Grading Rules.

⁴ These grades meet the requirements for density.

⁵ These grades are based on requirements for heartwood.

⁶ The grading rules provide a basis for obtaining higher shearing stresses of 140, 160 and 180 pounds per square inch when specified.

⁷ These grades are applicable to 2 inch thickness only.

⁸ See section 919.2 for adjustments for compression perpendicular to grain.

⁹ These grades are applicable only in sizes 3 inches and thicker.

TABLE 919b

WORKING STRESSES FOR GLUED LAMINATED STRUCTURAL MEMBERS

The working stresses below are for normal loading conditions. See section 919.2 for permissible adjustments in working stresses for loads of other types, and for species and grades not given in the following table.

SPECIES AND COMBINATIONS OF LUMBER GRADES				ALLOWABLE UNIT STRESSES IN POUNDS PER SQUARE INCH						
Combination Number	Outer Laminations		Inner Laminations	Extreme Fiber in Bending "f" _b -s	Tension Parallel to Grain "t"||-7		Compression Parallel to Grain "c"||-7	Horizontal Shear "H"||-11	Compression Perpendicular to Grain "c" _⊥ -1	
	Grade	Number, Each Side			From 4 to 14 Laminations	15 or More Laminations				From 4 to 14 Laminations
Dry Conditions of Use										
DOUGLAS FIR, COAST REGION:										
1.....	Clear (Dense)	One	Dense Select Structural	3,000	3,000	3,000	2,400	2,500	165	455
2.....	Clear (Dense)	One	Dense No. 1	3,000	3,000	3,000	2,200	2,300	165	435
3.....	Dense Select Structural	All	Dense Select Structural	2,800	3,000	3,000	2,400	2,500	165	435
4.....	Clear (Close-Grain)	One	Select Structural	2,800	2,800	2,800	2,200	2,200	165	415
5.....	Select Structural	All	Select Structural	2,600	2,800	2,800	2,200	2,200	165	415
6.....	Clear (Medium Grain)	1/5 of total	No. 1	2,600	2,800	2,400	2,000	2,000	165	415
7.....	Dense No. 1	One	No. 1	2,600	2,600	2,200	2,000	2,000	165	415
8.....	Dense No. 1	All	Dense No. 1	2,400	2,600	2,600	2,200	2,300	165	455
9.....	Dense No. 1	1/14 of total	No. 1	2,400	2,600	2,200	2,400	2,000	165	455
10.....	Select Structural	One	No. 1	2,400	2,600	2,200	1,900	2,000	165	455
11.....	Select Structural	1/5 of total	No. 2	2,200	2,600	2,400	1,900	2,000	165	415
12.....	Clear (Medium Grain)	One	No. 2	2,200	2,200	2,000	1,800	1,900	165	415
13.....	Select Structural	One	No. 2	2,200	2,200	2,000	1,800	1,900	165	390
14.....	No. 1	All	No. 1	2,000	2,200	2,200	1,800	2,000	165	415
15.....	No. 1	One	No. 2	2,000	2,200	2,000	1,800	1,900	165	390
16.....	No. 2	All	No. 2	1,600	2,000	2,000	1,800	1,900	165	390
PINE, SOUTHERN:										
1-1.....	No. 1 Dense	All	No. 1 Dense	3,000	3,000	3,000	2,400	2,500	200	450
1-2.....	B & B Dense	One	No. 1	3,000	3,000	2,600	2,100	2,100	200	450
1-3.....	No. 1 Dense	1/14 of total	No. 1	3,000	3,000	2,600	2,100	2,100	200	450
1-4.....	B & B Dense	One	No. 2 Dense	2,800	3,000	3,000	2,400	2,400	200	450
1-5.....	No. 1 Dense	1/5 of total	No. 2 Dense	2,800	3,000	2,800	2,300	2,400	200	450
1-6.....	No. 1 Dense	All	No. 1	2,600	3,000	2,600	2,100	2,100	200	450
1-7.....	B & B Dense	1/14 of total	No. 2	2,400	2,800	2,600	2,000	2,000	200	385
1-8.....	B & B	One	No. 2	2,400	2,400	2,600	2,000	2,000	200	385
1-9.....	No. 1	1/5 of total	No. 2	2,400	2,600	2,400	2,000	2,000	200	450
1-10.....	No. 2 Dense	All	No. 2 Dense	2,000	2,600	2,600	2,200	2,300	200	450
1-11.....	No. 2 Dense	1/14 of total	No. 2	2,000	2,600	2,200	1,900	2,000	200	450
1-12.....	No. 2	All	No. 2	1,800	2,200	2,200	1,600	2,000	200	385

Wet Conditions of Use

DOUGLAS FIR, COAST REGION¹

	Clear (Dense)	One	Dense Select Structural	2,400	2,400	2,400	2,400	1,700	1,800	145	305
1.....	Clear (Dense)	One	Dense No. 1	2,400	2,400	2,400	2,400	1,700	1,800	145	305
2.....	Clear (Dense)	All	Dense Select Structural	2,400	2,400	2,400	2,400	1,700	1,800	145	305
3.....	Clear (Dense)	All	Dense Select Structural	2,400	2,400	2,400	2,400	1,700	1,800	145	305
4.....	Clear (Close-Grain)	One	Dense No. 1	2,400	2,400	2,400	2,400	1,600	1,600	145	275
5.....	Select Structural	All	Select Structural	2,000	2,200	2,200	2,200	1,600	1,600	145	275
6.....	Clear (Medium Grain)	1/5 of total	No. 1	2,000	2,200	2,200	2,200	1,600	1,600	145	275
7.....	Clear (Medium Grain)	One	No. 1	2,000	2,200	2,200	2,200	1,600	1,600	145	275
8.....	Dense No. 1	All	Dense No. 1	2,000	2,200	2,200	2,200	1,600	1,700	145	305
9.....	Dense No. 1	1/14 of total	No. 1	2,000	2,200	2,200	2,200	1,400	1,400	145	305
10.....	Select Structural	One	No. 1	2,000	2,200	2,200	2,200	1,400	1,400	145	275
11.....	Select Structural	1/5 of total	No. 2	1,800	2,000	2,000	2,000	1,400	1,400	145	275
12.....	Clear (Medium Grain)	One	No. 2	1,800	1,800	1,800	1,800	1,300	1,400	145	260
13.....	Select Structural	One	No. 2	1,800	1,800	1,600	1,600	1,300	1,400	145	275
14.....	No. 1	All	No. 1	1,600	1,800	1,800	1,800	1,300	1,400	145	260
15.....	No. 1	One	No. 1	1,600	1,800	1,800	1,800	1,300	1,400	145	260
16.....	No. 2	All	No. 2	1,200	1,600	1,600	1,600	1,300	1,400	145	260

PINE, SOUTHERN¹

	No. 1 Dense	All	No. 1 Dense	2,400	2,400	2,400	2,400	1,800	1,800	175	300
2-1.....	No. 1 Dense	All	No. 1 Dense	2,400	2,400	2,400	2,400	1,800	1,800	175	300
2-2.....	B & B Dense	One	No. 1	2,400	2,400	2,400	2,400	1,500	1,500	175	300
2-3.....	No. 1 Dense	One	No. 1	2,400	2,400	2,400	2,400	1,500	1,500	175	300
2-4.....	B & B Dense	One	No. 2 Dense	2,400	2,400	2,400	2,400	1,700	1,700	175	300
2-5.....	No. 1 Dense	1/5 of total	No. 2 Dense	2,200	2,400	2,400	2,400	1,700	1,700	175	300
2-6.....	No. 1	All	No. 1	2,000	2,000	2,000	2,000	1,500	1,500	175	260
2-7.....	B & B Dense	1/14 of total	No. 2	1,800	2,200	2,200	2,200	1,500	1,500	175	300
2-8.....	B & B	One	No. 2	1,800	2,000	2,000	2,000	1,500	1,500	175	260
2-9.....	No. 1	1/5 of total	No. 2	2,000	2,000	2,000	2,000	1,400	1,500	175	260
2-10.....	No. 2 Dense	All	No. 2 Dense	1,600	2,000	2,000	2,000	1,000	1,700	175	300
2-11.....	No. 2 Dense	One	No. 2	1,600	2,000	1,800	2,000	1,400	1,700	175	300
2-12.....	No. 2	All	No. 2	1,400	1,800	1,800	2,000	1,400	1,400	175	260

¹Standard Specifications for Design and Fabrication of Structural Glued Laminated Lumber," by West Coast Lumbermen's Association, applies.

²Standard Specifications for Structural Glued Laminated Southern Pine," by Southern Pine Inspection Bureau, applies.

³The Modulus of Elasticity (E) is 1,800,000 pounds per square inch for dry conditions of use.

⁴The Modulus of Elasticity (E) is 1,600,000 pounds per square inch for wet conditions of use.

⁵The rate of growth and density requirements of inner laminations shall apply to clear outer laminations.

⁶In grade combinations 1-1, 1-6, 2-1, and 2-6 no provision has been made for use of B & B grade in outermost laminations because higher stress rating would not be justified. If, in these combinations, B & B quality is desired for one or both faces of a member to improve appearance, it should be particularly specified.

⁷For special slope of grain requirements see applicable specifications listed in Notes Nos. 1 and 2.

⁸The allowable unit stresses in bending in 919b apply only when the wide faces of the laminations are placed normal to the direction of the load. For allowable stresses in bending when the loading is applied parallel to the planes of the laminations, see the applicable specification indicated in 1 and 2.

the section thus found is not less than required for dead load and live loads alone.

(d) Minimum sizes of lumber members required by this code refer to nominal sizes. Dressed sizes of sawn lumber and finished sizes of structural glued laminated lumber conforming to nationally recognized good practice shall be accepted as the minimum net sizes conforming to nominal sizes.

(e) The building official may require the species and grade or the stress-grade of all wood used for load bearing purposes to be stated on the plans filed with the building official.

(f) "Grade," when used in connection with lumber for structural purposes, is a classification with respect to strength.

(g) The allowable compression stress perpendicular to the grain may be increased in accordance with the following factors for bearings less than 6 inches in length and located 3 inches or more from the end of the timber.

Length of bearing

(Inches) .. $\frac{1}{2}$	1	$1\frac{1}{2}$	2	3	4	5
Factor	1.75	1.38	1.25	1.19	1.13	1.10

(h) For stress under washers or small plates, the same factor may be taken as for a bearing the length of which equals the diameter of the washer.

919.3. Washers.

A washer not less than a standard cut washer, or in lieu thereof a metal plate or strap, shall be between the wood and the bolt head and between the wood and the nut.

919.4. Beams, girders and joists.

(a) Wood beams, girders and joists shall have bearings such that the bearing stress is within the limits fixed in section 919.2 but in no case shall the length of bearing be less than 3 inches on masonry or concrete, or $1\frac{1}{2}$ inches on wood or metal, except that joists may be supported on a 1-inch let-in ribbon when the joists are nailed to the studs.

(b) No wood beam, girder or joist shall be cut or pierced in any manner that would cause it to be of insufficient strength for its load.

919.5. Wood columns in lowest story.

(a) Wood columns in the lowest story of a building or structure shall rest on masonry or reinforced concrete footings extending not less than 3 inches above the floor level and shall be securely anchored thereto.

(b) Where it is necessary to protect wood columns against excessive dampness approved preservatives shall be applied to the columns.

919.6. Ground clearance of framework.

All parts of exposed wooden framework shall be kept at least 6 inches above ground level or the wood shall be treated to such height with an approved preservative.

SECTION 920. WALL VENEERING.**920.1. Masonry veneers exceeding $1\frac{1}{2}$ inches in thickness.**

(a) Materials used for masonry veneering covered by this section shall be not less than the following thicknesses:

Material	Thickness (Inches)
Solid masonry units (stone, burned clay, cast stone)	$1\frac{5}{8}$
Hollow masonry units (burned clay or concrete)	3

(b) Height. Masonry veneer shall not exceed 35 feet in height above foundations or other approved support.

(c) Attachment of masonry veneer.

(1) Masonry veneer shall be tied into the masonry backing either by a header for every 4 square feet of wall surface, extending at least 4 inches into the backing, or by substantial corrosion resistant metal wall ties spaced not farther apart than 24 inches both horizontally and vertically.

(2) Masonry veneers on wood, steel or reinforced concrete framing shall be attached to the building or structure with corrosion resistant nails or ties spaced not farther apart than 24 inches both horizontally and vertically, and not less than one nail or tie for each 3 square feet of wall surface.

(3) Masonry veneers on wood frame shall be supported on the foundation. Masonry veneers on steel or reinforced concrete framing may be supported on the foundation or by other approved noncombustible supports.

(d) Flashing. Corrosion resistant flashing to prevent moisture from penetrating behind the veneer shall be provided over wall openings and other places as may be required by generally accepted good practice.

920.2. Exterior veneers $1\frac{1}{2}$ inches or less in thickness.

(a) Veneers $1\frac{1}{2}$ inches or less in thickness shall be corrosion resistant or protected by an approved corrosion resistant surfacing and shall be securely attached to the supporting construction with approved hangers, clips or other anchoring devices, except as otherwise provided in paragraph (g)(4) of this section, to prevent the loosening of the veneers by frost or other action. The anchors shall be of such size, quality and spacing as required by generally accepted good practice.

(b) The joints of veneers $1\frac{1}{2}$ inches or less in thickness shall be protected against the weather by caulking, pointing or other approved method.

(c) Supports shall be adequately protected against the weather and moisture by painting, galvanizing or other approved methods.

(d) Exterior veneers $1\frac{1}{2}$ inches or less in thickness shall not be installed more than 35 feet above grade level unless positive support and anchorage is provided for each unit of the veneer, the backing is not supported by wood members and the installation is approved by the building official. On buildings of wood frame construction no exterior masonry or structural glass veneer shall be installed above the second floor level nor more than 15 feet above grade level.

(e) Metal veneers. Exterior metal veneers shall be securely attached to the supporting masonry or framing members with corrosion resistant fastenings spaced not more than 24 inches both horizontally and vertically. Units which exceed 4 square feet in area shall have not less than 4 attachments per unit.

(f) Structural glass veneers.

(1) Structural glass veneers shall be not less than $11/32$ of an inch in thickness and the area of a single section shall not exceed 10 square feet where not more than 15 feet above the grade level directly below, and shall not exceed 6 square feet where more than 15 feet above that level. The maximum length or height of any section shall not exceed 4 feet.

(2) Glass shall be set in place with an approved mastic cement over an approved bond coat applied to the backing. At least 50 per cent of the area of each glass unit shall be directly bonded to the backing by mastic not less than $\frac{1}{4}$ inch thick and not more than $\frac{5}{8}$ inch thick. Where the glass extends to the sidewalk surface each section shall rest in an approved metal moulding.

(3) The backing for structural glass veneers shall be of masonry or of cement plaster not less than one inch thick on metal lath or of concrete, or other approved noncombustible material of approved stability. Where cement plaster on metal lath supported by wood or other framing members is used as backing, the framing members shall be spaced not more than 12 inches on centers.

(g) Exterior masonry veneer.

(1) Materials used for exterior masonry veneer shall be sound and durable and free from fissures.

(2) Exterior masonry veneer units exceeding 144 square inches in area shall be not less than $\frac{7}{8}$ inch in thickness when installed 15 feet or less above grade level, and not less than $1\frac{1}{4}$ inches in thickness when installed more than 15 feet above grade level.

(3) The backing for exterior masonry veneer shall be of masonry, or of cement plaster not less than one inch thick on metal lath, or of concrete, or other approved noncombustible material of approved stability. Where cement plaster on metal lath supported by wood or other framings is used as backing, the framing members shall be spaced not more than 12 inches on centers.

(4) Masonry veneer units less than one inch in thickness and having a scored or keyed back may be attached to a masonry or reinforced concrete wall with Type A-1 mortar when the mortar bond has a shearing stress of 50 pounds per square inch.

SECTION 921. LATHING AND PLASTERING.

Lathing and plastering shall conform with nationally recognized good practice on matters not covered in this code.

SECTION 922. PLASTIC LIGHT DIFFUSING CEILINGS.

922.1. Where permitted.

Plastic light diffusing ceilings which fall from their mounting upon application of heat shall not be installed in any exit way required by sections 602 and 603, nor in places of assembly, or rooms or spaces used for institutional occupancy.

922.2. Approval of building official.

The installation of a plastic light diffusing ceiling shall be subject to the approval of the building official.

922.3. Flame spread rating requirements.

A plastic light diffusing ceiling shall conform to the requirements for interior finish materials in section 808, except that a plastic light diffusing ceiling, the plastic panels of which have been shown in appropriate tests by a recognized testing laboratory to fall from their mounting before being ignited by application of heat shall be exempt from this provision provided the plastic panels are made up of individual lengths not exceeding 10 feet each.

922.4. Installation in sprinklered areas.

No plastic light diffusing ceiling shall be installed below sprinklers in areas required to be equipped with automatic sprinklers by section 810 or section 402, unless appropriate tests by a nationally recognized testing laboratory have shown that such ceiling does not prevent effective protection by the sprinklers; or unless sprinklers are located both above and below the light diffusing ceiling.

922.5. Attachment of supports.

The supports for plastic panels of light diffusing ceilings shall be securely fastened in an approved manner to the ceiling, floor or roof construction.

SECTION 923. FLOORS ON THE GROUND.

Floors resting directly on the ground shall be protected in an approved manner against dampness from below the floor.

SECTION 924. GLASS FLOOR LIGHTS.

Glass floor lights in the floors between stories of a building are prohibited.

ARTICLE X.**CHIMNEYS, FLUES AND VENTS.****SECTION 1000. CHIMNEYS — GENERAL REQUIREMENTS.****1000.1. Height.**

(a) Chimneys for low heat appliances shall extend at least 3 feet above the highest point where they pass through the roof of a building and at least 2 feet higher than any portion of the building within 10 feet.

(b) Chimneys for medium heat appliances shall extend not less than 10 feet higher than any portion of any building within 25 feet.

(c) Chimneys for high heat appliances shall extend not less than 20 feet higher than any portion of any building within 50 feet.

(d) Chimneys of flue-fed incinerators shall be of the height specified in section 1005.2(k).

(e) Chimneys of commercial and industrial type incinerators shall be of the height specified in section 1005.3(g).

1000.2. Clearance from combustible material.

Clearance between chimneys and combustible material shall be not less than specified in section 807.

1000.3. Smoke test.

Chimneys shall be proved tight by a smoke test after erection and before being put into use.

SECTION 1001. MASONRY CHIMNEYS — GENERAL REQUIREMENTS.**1001.1. Support.**

Masonry chimneys shall be supported on foundations of masonry or reinforced concrete or other noncombustible material having a fire resistance rating of not less than 3 hours.

1001.2. Corbeling.

No chimney shall be corbeled from a wall more than 6 inches; nor shall a chimney be corbeled from a wall which is less than 12 inches in thickness unless it projects equally on each side of the wall; provided that in the second story of 2-story dwellings corbeling of chimneys on the exterior of the enclosing walls may equal the wall thickness. Corbeling shall not exceed one inch projection for each course of brick projected.

1001.3. Change in size or shape at roof not permitted.

No change in the size or shape of a chimney, where the chimney passes through the roof, shall be made within a distance of 6 inches above or below the roof joists or rafters.

SECTION 1002. MASONRY CHIMNEYS FOR LOW HEAT APPLIANCES.

(Sections 1000 and 1001 also apply)

1002.1. Appliances classed as low heat appliances.

Low heat appliances shall include ranges, heating stoves, warm air heating furnaces, water heaters and hot water heating boilers, steam boilers operating at not over 50 pounds per square inch gauge pressure, steam boilers of not over 10 boiler horsepower regardless of operating pressure, domestic type incinerators, bakery ovens, candy furnaces, coffee roasting ovens, core ovens, lead melting furnaces, rendering furnaces, stereotype furnaces, wood drying furnaces, and other furnaces classified as low heat appliances in accordance with nationally recognized good practice. Appliances otherwise classed as medium heat appliances may be considered as low heat appliances if not larger than 100 cubic feet in size.

1002.2. Construction.

Masonry chimneys for low heat appliances shall be constructed of solid masonry units or of reinforced concrete. Chimneys in dwellings, chimneys for domestic type low heat appliances and chimneys for building heating equipment for heating a total volume of occupied space not to exceed 25,000 cubic feet shall have walls not less than 4 inches thick. In other buildings and for other low heat appliances the thickness of chimney walls shall be not less than 8 inches, except that rubble stone masonry shall be not less than 12 inches thick.

1002.3. Liners.

(a) Masonry chimneys for low heat appliances shall be lined with approved fire clay flue liners not less than $\frac{5}{8}$ of an inch thick, or with other approved liner of material that will resist without softening or cracking a temperature of 1800 Fahrenheit.

(b) Fire clay flue liners shall be installed ahead of the construction of the chimney as it is carried up, carefully bedded one on the other in Type A, Type B or fire clay mortar with close fitting joints left smooth on the inside.

(c) In masonry chimneys with walls less than 8 inches thick liners shall be separate from the chimney wall and the space between the liner and masonry shall not be filled; only enough mortar shall be used to make a good joint and hold the liners in position.

(d) Flue liners shall start from a point not less than 8 inches below the intake, or, in the case of fireplaces, from the throat of the fireplace. They shall extend, as nearly vertically as possible, for the entire height of the chimney.

1002.4. Two or more flues in one chimney.

(a) Where two flues adjoin each other in the same chimney with only flue lining separation between them, the joints of the adjacent flue linings shall be staggered at least 7 inches.

(b) Where more than two flues are located in the same chimney, masonry wythes at least 4 inches wide and bonded into the masonry walls of the chimney shall be built at such points between adjacent flue linings that there are not more than two flues in any group of adjoining flues without such wythe separation.

1002.5. Cleanout openings.

Where cleanout openings are provided in chimneys they shall be equipped with metal doors and frames arranged to remain tightly closed when not in use.

SECTION 1003. MASONRY CHIMNEYS FOR MEDIUM HEAT APPLIANCES.

(Sections 1000 and 1001 also apply.)

1003.1. Appliances classed as medium heat appliances.

Medium heat appliances shall include annealing furnaces (glass or metal), charcoal furnaces, galvanizing furnaces, gas producers and steam boilers of over 10 boiler horsepower operating at over 50 pounds per square inch gauge pressure when such appliances are larger than 100 cubic feet in size, and other furnaces classified as medium heat appliances in accordance with nationally recognized good practice. Appliances otherwise classed as high heat appliances may be considered as medium heat appliances if not larger than 100 cubic feet in size.

1003.2. Construction.

Masonry chimneys for medium heat appliances shall be constructed of solid masonry units or of reinforced concrete not less than 8 inches thick, except that stone masonry shall be not less than 12 inches thick; and in addition, shall be lined with not less than 4½ inches of fire brick laid on the 4½-inch bed in fire clay mortar, starting not less than 2 feet below the flue pipe entrance and extending for a distance of at least 25 feet above the flue pipe entrance.

SECTION 1004. MASONRY CHIMNEYS FOR HIGH HEAT APPLIANCES.

(Sections 1000 and 1001 also apply.)

1004.1. Appliances classed as high heat appliances.

High heat appliances shall include billet and bloom furnaces, blast furnaces, brass furnaces, brick kilns, coal gas retorts, cupolas, earthenware kilns, glass furnaces, open hearth furnaces, porcelain baking and glazing kilns and water gas retorts when such appliances are larger than 100 cubic feet in size, and other furnaces classified as high heat appliances in accordance with nationally recognized good practice.

1004.2. Construction.

Masonry chimneys for high heat appliances shall be constructed with double walls of solid masonry units or of reinforced concrete, each not less than 8 inches in thickness, with an air space of not less than 2 inches between them. The inside of the interior walls shall be of fire brick not less than $4\frac{1}{2}$ inches in thickness laid on the $4\frac{1}{2}$ -inch bed in fire clay mortar.

SECTION 1005. MASONRY CHIMNEYS FOR INCINERATORS.**1005.1. Domestic type incinerators.**

Masonry chimneys for domestic type incinerators shall be constructed in accordance with the requirements for masonry chimneys for low heat appliances, section 1002.

1005.2. Flue-fed incinerators (apartment house type).

(a) The flue of flue-fed incinerators shall serve the incinerator only and be used for no other purpose.

(b) The flue liner shall be straight and plumb and shall be smooth on the inside.

(c) The size of incinerator flues shall be in accordance with the following:

1. Where not more than one service opening is provided, the size of flue shall be not less than 14 by 14 inches or 196 square inches, inside measurements, except that in one family dwellings the size shall be not less than 12 by 12 inches or 144 square inches.

2. Where two to six service openings are provided, the size of flue shall be not less than 18 by 18 inches or 324 square inches, inside measurements.

3. Where seven or more service openings are provided, the size of flue shall be not less than 22 by 22 inches or 484 square inches, inside measurements.

(d) A chimney serving an incinerator with a combustion chamber having a horizontal combined hearth and grate area of 7 square feet or less shall have walls of clay or shale brickwork not less than 4 inches thick with a lining of $4\frac{1}{2}$ inches of fire brick for a distance of not less than 10 feet above the roof of the combustion chamber; beyond this point chimney walls shall consist of not less than 8 inches of clay or shale brickwork with a standard fire clay flue liner not less than $\frac{5}{8}$ inch in thickness extending from the top of the fire brick lining to the top of the chimney.

(e) A chimney serving an incinerator with a combustion chamber having a horizontal combined hearth and grate area exceeding 7 square feet shall have walls of clay or shale brickwork not less than 4 inches thick with a lining of $4\frac{1}{2}$ inches of fire brick for a distance of not less than 40 feet above the roof of the combustion chamber; beyond this point, chimney walls shall consist of not less than 8 inches of clay or shale brickwork with a standard fire clay flue liner extending from the top of the fire brick lining to the top of the chimney.

(f) Other constructions may be used if equivalent to the constructions outlined in the preceding paragraphs, in structural strength, insulating value and ability to withstand thermal expansion and flame impingement.

(g) Fire brick shall be laid in high temperature cement or fire clay mortar.

(h) Clearance between chimneys and combustible material shall be not less than specified in section 807.

(i) A flue that is divided into two channels, one for feeding refuse and the other for the discharge of combustion gases, shall be constructed as specified in this subsection 1005.2.

(j) Chimneys of flue-fed incinerators shall be supported on foundations of masonry or reinforced concrete or other noncombustible material having a fire resistance rating of not less than 3 hours. They shall be so constructed as not to place excessive stress upon the roof of the combustion chamber.

(k) Chimneys of flue-fed incinerators shall extend at least 4 feet above sloping roofs measured from the highest point at which the chimney passes through the roof and at least 8 feet above flat roofs. In either case, the chimney shall extend at least 2 feet higher than any portion of a building within 20 feet.

(l) All flues shall terminate in a substantially constructed spark arrester with openings not greater than $\frac{1}{2}$ inch, or be provided with other suitable means for avoiding discharge of fly particles. Expansion chambers used as a secondary combustion chamber shall be constructed equivalent to that of the incinerator combustion chamber. Those used only for settling shall be of construction equivalent to that of the upper portion of incinerator

chimney and with clearances to combustible construction as specified by section 807. Expansion chambers shall be provided with substantial noncombustible supports. Every expansion chamber shall have a vent of cross-sectional area at least equal to that of the flue.

1005.3. Commercial and industrial type incinerators.

(a) Chimneys of commercial and industrial type incinerators, except as provided in the following paragraphs (b) and (c), shall be not less than 8 inches of clay or shale brickwork or reinforced concrete or a metal chimney, lined with fire brick not less than 4½ inches thick for the full height of the chimney.

(b) Subject to approval by the building official, commercial and industrial type incinerators may be connected to chimneys constructed of 8 inches of clay or shale brickwork or reinforced concrete lined with fire clay flue liner, or to a metal chimney, where the incinerator is specially constructed to produce low flue gas temperatures.

(c) Other constructions may be used if equivalent to the construction outlined in the preceding paragraphs, in structural strength, insulating value and ability to withstand thermal expansion and flame impingement.

(d) Fire brick and other refractory lining shall be laid in high temperature cement or fire clay mortar.

(e) Clearances between chimneys and combustible material shall be not less than specified in section 807.

(f) Chimneys of commercial and industrial type incinerators shall be supported on foundations of masonry or reinforced concrete or other noncombustible material having a fire resistance rating of not less than 3 hours. They shall be so constructed as not to place excessive stress upon the roof of the combustion chamber.

(g) Chimneys of commercial and industrial type incinerators shall extend at least 4 feet above sloping roofs measured from the highest point at which the chimney passes through the roof and at least 8 feet above flat roofs. In either case, the chimney shall extend at least 2 feet higher than any portion of a building within 20 feet.

(h) Incinerators may be connected to industrial or similar chimneys serving heat-producing appliances provided the cross-sectional area of such chimney is adequate for the combined services and its construction is suitable for the chimney flue gas temperature.

(i) Incinerators used for the burning of rubbish or other readily combustible solid waste material shall include effective means for arresting sparks and fly particles, such as an expansion chamber, baffle walls, or other effective arrangement, or the flues

of such incinerators shall be provided with an approved spark arrester having openings not greater than $\frac{3}{4}$ inch.

SECTION 1006. FIREPLACES.

(a) Fireplaces shall be constructed of solid masonry or of reinforced concrete with back and sides of the thickness specified in this paragraph, except as provided by the following paragraph (b). Where a lining of fire brick at least 2 inches thick or other approved lining is provided, the total thickness of back and sides including the lining shall be not less than 8 inches. Where no such lining is provided, the thickness of back and sides shall be not less than 12 inches.

(b) Factory-built fireplaces that are approved as a result of tests and listing by a nationally recognized testing laboratory need not conform to the above paragraph (a) provided they are installed in accordance with the conditions of the approval.

(c) Fireplace hearth extensions shall be provided of approved noncombustible material for all fireplaces. Where the fireplace opening is less than 6 sq. ft., the hearth extension shall extend at least 16 in. in front of, and at least 8 in. beyond each side of the fireplace opening. Where the fireplace opening is 6 sq. ft. or larger, the hearth extension shall extend at least 20 in. in front of, and at least 12 in. beyond each side of the fireplace opening. Where a fireplace is elevated above or overhangs a floor the hearth extension shall also extend over the area under the fireplace.

(d) Fireplaces constructed of masonry or reinforced concrete shall have hearth extensions of brick, concrete, stone, tile or other approved noncombustible material properly supported and with no combustible material against the underside thereof. Wooden forms or centers used during the construction of hearth and hearth extension shall be removed when the construction is completed.

(e) Hearth extensions of approved factory-built fireplaces shall be not less than $\frac{3}{8}$ in. thick of asbestos, concrete, hollow metal, stone, tile or other approved noncombustible material. Such hearth extensions may be placed on the sub or finish flooring whether the flooring is combustible or not. The hearth extension shall be readily distinguishable from the surrounding floor.

(f) Clearances between fireplaces of masonry or reinforced concrete and combustible material shall be not less than specified in section 807. Clearances between approved factory-built fireplaces and combustible material shall be not less than specified in the approval.

(g) Spaces between fireplaces and combustible material shall be firestopped as specified in section 807.

SECTION 1007. LABORATORY TESTED FACTORY-BUILT CHIMNEYS.

Factory-built chimneys that are approved as a result of tests and listing by a nationally recognized testing laboratory shall be installed in accordance with the conditions of the approval.

SECTION 1008. METAL CHIMNEYS (SMOKESTACKS).**1008.1. Construction.**

(a) Metal chimneys shall be of adequate thickness, properly riveted or welded, and securely supported. Metal shall be galvanized or painted unless suitably corrosion resistant.

(b) Metal chimneys used for high heat appliances as defined in section 1004.1 shall be lined with not less than 4½ inches of fire brick laid in fire clay mortar extending not less than 25 feet above the smoke pipe entrance.

1008.2. Clearances for exterior metal chimneys.

Metal chimneys erected on the exterior of a building shall have sufficient clearance from buildings and structures to avoid overheating combustible material, to permit inspection and maintenance operations on the chimney, and to avoid danger of burns to persons using any nearby exit way, in accordance with the following:

(a) Exterior metal chimneys used only for low heat appliances as defined in section 1002.1 burning gas shall have a clearance of not less than 6 inches from a wall of wood frame construction and from any combustible material.

(b) Exterior chimneys used for low heat appliances as defined in section 1002.1 burning any fuel other than gas shall have a clearance of not less than 12 inches from a wall of wood frame construction and from any combustible material.

(c) Exterior chimneys used for medium heat appliances as defined in section 1003.1 shall have a clearance of not less than 24 inches from a wall of wood frame construction and from any combustible material.

(d) Exterior metal chimneys over 6 inches in outside diameter shall have a clearance of not less than 2 inches, and those over 18 inches in diameter a clearance of not less than 4 inches from a building wall of other than wood frame construction.

(e) No portion of an exterior metal chimney shall be nearer than 24 inches to any door or window or to any exit way, unless insulated or shielded in an approved manner to avoid burning a person who might touch the chimney.

1008.3. Enclosure of interior metal chimneys.

(a) Where a metal chimney extends through any story of a building above that in which the appliances connected to the chimney are located, it shall be enclosed in such upper stories with walls of noncombustible construction having a fire resistance rating of not less than one hour.

(b) The enclosure shall provide a space on all sides of the chimney sufficient to permit inspection and repair.

(c) The enclosing walls shall be without openings, except doorways equipped with approved self-closing fire doors at various floor levels for inspection purposes.

1008.4. Passage through roof.

(a) Where a metal chimney serving only low heat appliances as defined in section 1002.1 passes through a roof constructed of combustible material, it shall be guarded by a ventilating thimble of galvanized iron or approved corrosion resistant metal, extending not less than 9 inches below and 9 inches above the roof construction, and of a size to provide not less than 6 inches clearance on all sides of the chimney; or the combustible material in the roof construction shall be cut away so as to provide not less than 18 inches clearance on all sides of the chimney, with any material used to close up such opening entirely noncombustible.

(b) Where a metal chimney serving a medium heat appliance as defined in section 1003.1 passes through a roof constructed of combustible material, it shall be guarded by a ventilating thimble of galvanized iron or approved corrosion resistant metal, extending not less than 9 inches below and 9 inches above the roof construction, and of a size to provide not less than 18 inches clearance on all sides of the chimney.

1008.5. Location in ventilating ducts restricted.

Metal chimneys shall not be carried up inside of ventilating ducts unless such ducts are constructed as required by this article for chimneys and are used solely for exhaust of air from the room or space in which the appliance served by the chimney is located.

SECTION 1009. GAS VENTS.**1009.1. Types of vents which may be used.**

Gas appliance vents that do not conform to the requirements of this article for chimneys shall be of one of the following types installed as required by this section.

(a) Type B gas vents—Vent piping of noncombustible, corrosion resistant material approved as a result of tests and listing by a nationally recognized testing laboratory for venting of gas appliances.

(b) Type BW gas vents—Vent piping of noncombustible, corrosion resistant material approved as a result of tests and listing by a nationally recognized testing laboratory for venting recessed gas heaters.

(c) Type C gas vents—Vent piping of sheet copper of not less than No. 24 gauge or of galvanized iron of not less than No. 20 gauge or of other approved noncombustible corrosion resistant material.

1009.2. Height.

Gas vents shall extend at least 2 feet above the highest point where they pass through the roof of a building and at least 2 feet higher than any portion of the building within 10 feet, except that gas vents need not comply with this provision when equipped with an approved device which assures proper and effective venting as installed.

1009.3. Use limits.

(a) Type B gas vents shall be used only with approved gas appliances which produce flue gas temperatures not in excess of 550 F. They shall not be used for venting:

- (1) Incinerators;
- (2) Appliances which may be converted readily to the use of solid or liquid fuel;
- (3) Boilers and furnaces, other than attic furnaces, except where specific approval is obtained from the building official for use of type B gas vents.

(b) Type BW gas vents shall be used only with approved recessed gas heaters.

(c) Type C gas vents shall be used only for runs directly from the space in which the appliance is located through the roof or exterior wall to the outer air. Such vents shall not pass through any attic or concealed space nor through any floor; but may be used to vent attic furnaces.

1009.4. Marking of gas vents.

Gas vents which are not suitable for use with solid or liquid fuel burning appliances shall be plainly and permanently labeled: "This flue is for appliances which burn gas only," unless permission to omit this marking is granted by the building official.

1009.5. Installation of type B and type BW gas vents.

Type B and type BW gas vents shall be installed in full compliance with the terms of their approval.

1009.6. Installation of type C gas vents.

(a) Type C gas vents shall be installed with clearances from combustible material of not less than 9 inches except that for vertical portions of the vent the clearance may be 6 inches.

(b) Where a type C gas vent goes through an exterior wall constructed of combustible material, except as provided in subparagraph (4), it shall be guarded at the point of passage by a ventilating metal thimble not smaller than the following:

(1) For gas burning appliances, except floor furnaces and incinerators, that have been tested by an approved agency and found to have flue gas temperatures not exceeding 550 F.—4 inches larger in diameter than the vent pipe, unless there is a run of not less than 6 feet of vent pipe in the open, between the draft hood outlet and the thimble, in which case the thimble may be 2 inches larger in diameter than the vent pipe;

(2) For gas burning floor furnaces and for all gas burning appliances that have not been found by test by an approved agency to have flue gas temperatures of 550 F. or less—6 inches larger in diameter than the vent pipe;

(3) For gas burning incinerators—12 inches larger in diameter than the vent pipe.

(4) In lieu of thimble protection all combustible material in the wall shall be cut away from the vent pipe a sufficient distance to provide the clearance required from such vent pipe to combustible material, with any material used to close up such opening entirely noncombustible.

(c) Where a type C gas vent goes through a roof constructed of combustible material it shall be guarded at the point of passage as specified for passage through a combustible exterior wall by section 1009.6(b), or by a noncombustible non-ventilating thimble not less than 4 inches larger in diameter than the vent pipe and extending not less than 18 inches above and 6 inches below the roof with the annular space open at the bottom and closed only at the top.

ARTICLE XI.

HEAT PRODUCING APPLIANCES, HEATING, VENTILATING, AIR CONDITIONING, BLOWER AND EXHAUST SYSTEMS.

SECTION 1100. INSTALLATION STANDARDS.

Heat producing appliances and systems (including incinerators) shall be installed in accordance with standard practices for safe installation and use without danger of overheating combustible material or construction. Ventilating, air conditioning, blower and exhaust systems shall be installed in accordance with standard practice for safe installation and use with all features presenting a possibility of starting or spreading a fire safeguarded to a reasonable degree. Installation of such appliances and systems in accordance with the "Code for Heat Producing Appliances, Heating, Ventilating, Air Conditioning, Blower and Exhaust Systems" recommended by the National Board of Fire Underwriters shall be deemed to be the standard practice for safe installation and use. (See Appendix I.)

SECTION 1101. BOILER AND FURNACE ROOMS.

Boiler and furnace rooms as listed below shall be separated from other parts of the building by walls, partitions, and floor and ceiling assemblies, having a fire resistance rating of not less than one hour with door openings protected by approved self-closing fire doors:

(1) Heating boiler and furnace rooms in buildings used for assembly, educational, high hazard, hotel, institutional and multifamily house occupancies.

(2) Boiler rooms housing one or more steam boilers carrying more than 15 pounds pressure with a rating of more than 10 boiler horsepower, in buildings of other than industrial occupancy.

ARTICLE XII.**SAFEGUARDS DURING CONSTRUCTION.****SECTION 1200. GENERAL.**

The provisions of this article shall apply to all work in connection with the erection, alteration, repair, removal or demolition of buildings or structures.

SECTION 1201. SCAFFOLDS.**1201.1. Construction.**

All scaffolds shall be designed and constructed in accordance with nationally recognized good practice to support the loads that may be imposed thereon to insure the safety of persons working on them or passing under or near them. In no case shall scaffolds be designed for a live load of less than 125 pounds per square foot.

1201.2. Guard rails and toe boards.

(a) Every scaffold, the platform level of which is more than 6 feet above the ground or above a permanent or temporary floor, other than iron workers' scaffolds and carpenters' bracket scaffolds, shall be provided with guard rails not less than 36 inches high above the platform level, and with solid toe boards not less than 6 inches high above the platform level, extending its entire length and along the ends, except where ramps or runways connect with them, unless otherwise enclosed or guarded.

(b) If material on the platform is piled higher than the toe boards the space between guard rails and toe boards shall be filled with wire mesh screens securely attached.

1201.3. Overhead protection.

When objects are likely to fall on a scaffold from above, substantial overhead protection shall be provided not more than 10 feet above the scaffold platform.

1201.4. Planking.

Planks used for the platforms of scaffolds shall be not less than 2 inches thick, nominal dimension, of sound, seasoned lumber.

1201.5. Scaffolding.

Where a large amount of scaffolding is used, the building official may require the use of noncombustible material or of approved fire retardant treated lumber that has been treated by a pressure impregnation process. The building official may also require the flameproofing of tarpaulins.

SECTION 1202. SIDEWALK SHEDS AND WALKWAYS.**1202.1. Sheds required.**

Whenever a building or structure within 10 feet of a street line is to be erected or raised to exceed 40 feet in height, or whenever such a building or structure more than 25 feet in height is to be demolished, unless the street is officially closed during the construction or demolition, the owner or the person doing or causing such work to be done shall erect and maintain during such work adjacent to the street lines, sheds of sufficient strength and stability to sustain safely the weight of materials that may be placed thereon and to withstand the shocks incident to the handling of such materials or their preparation for use and to the accidental jars from trucks or delivering material.

1202.2. Railings and toe boards.

When the roofs of such sheds are used for the storage of material or for the performance of work of any kind, substantial railings not less than 3 feet high and solid toe boards not less than 6 inches high shall be placed along the open sides and ends of such roofs.

1202.3. Walkways.

(a) Sidewalk sheds shall be constructed to afford an unobstructed walkway for pedestrians, not less than 8 feet high and 4 feet wide.

(b) When the area occupied by the sidewalk or temporary walkway is to be excavated, such walk shall be designed to support a load of not less than 150 pounds per square foot and shall be provided with suitable ramps at each end. Such walkways shall be not less than 4 feet wide and provided with a fence or a handrail not less than 3 feet high.

SECTION 1203. TEMPORARY FENCE OR BARRICADE.

During a building operation the owner or person doing or causing such work to be done, shall, unless released by the building official, erect and maintain a substantial fence not less than 8 feet high. The fence shall extend along the street line for the entire length of the building and each end shall be turned and extended to the building line. Such fence may extend not more than 8 feet from the street line into the street, and shall be built solid for its full length except for such openings, provided with sliding doors or doors swinging inward, as may be necessary for a proper prosecution of the work.

SECTION 1204. HOISTS.**1204.1. General.**

Temporary interior and exterior hoists shall be constructed, installed and maintained in accordance with nationally recognized good practice on matters not covered in this code.

1204.2. Interior hoists.

(a) Temporary construction hoists on the interior of buildings or structures shall have the car substantially constructed, the guides rigidly secured and overhead machinery safely supported.

(b) The floor openings or other spaces through which they operate shall be enclosed on all sides and for their full height, except for the necessary doors for loading and unloading, with barriers so constructed that heads, arms or legs cannot be thrust through them or loose material cannot fall through.

1204.3. Exterior hoists.

Temporary construction hoists on the exterior of buildings or structures shall be erected on sufficiently solid foundations to avoid injurious settlement or distortion.

1204.4. Hoisting machinery.

(a) Hoisting machinery, including boilers, if any, shall be placed to avoid unnecessary hazards and to provide ample room for the free and safe movement of operation.

(b) Such machinery shall be enclosed to exclude unauthorized persons and if placed outside the building further protection against falling objects shall be provided.

(c) When such hoisting machinery is placed within a building or structure, or within 10 feet of any part thereof, only non-combustible materials shall be used for the exterior covering of the enclosures.

(d) If hoisting machinery is operated by steam with boiler on or adjacent to premises, suitable spark guards shall be provided for smokestack.

SECTION 1205. ELEVATORS.

(a) When a building exceeding 60 feet in height is to be equipped with one or more elevators, at least one of such elevators shall be installed, in a properly enclosed shaft, as soon as construction conditions permit.

(b) Such elevator shall be maintained in operative condition and ready for service at all times.

(c) No elevator shall be used for passenger or freight service until the elevator shall have been tested under contract load and the car safety and terminal stopping equipment have been tested

to determine the safety of the equipment and until permanent or temporary guards or enclosures are placed on the car and around the hoistway and at the landing entrances on each floor. Landing entrance guards shall be provided with locks that can be released from the hoistway side only. Automatic and continuous pressure elevators shall not be placed in temporary operation from the landing push buttons unless door locking devices and interlocks required by section 1301.3 are installed and operative.

SECTION 1206. FLOORING.

1206.1. Working floor.

In buildings or structures the entire tier of beams on which construction of the frame is proceeding, known as the working floor, shall be planked over, except spaces required for construction work, for raising or lowering materials and for stairways or ladders.

1206.2. Permanent floors.

In building or structures the permanent structural floor, except for necessary temporary openings, shall be installed as the construction progresses. There shall be not more than 4 unfilled floors above the highest permanent floor, nor more than one unfilled floor between permanent floors.

1206.3. Wood construction.

In buildings of ordinary construction or heavy timber construction the structural floor shall be laid for each story as the building progresses, or if double floors are not to be used, the floor 2 stories below the one where work is under way shall be planked over.

SECTION 1207. FLOOR OPENINGS.

All floor openings, unless guarded by permanent enclosures or full-height temporary barriers, shall be covered with substantial temporary flooring, or guarded on all sides by substantial railings not less than 4 feet high set at least 2 feet from the edges of the openings, and by toe boards not less than 6 inches high set along the edges of the openings, except for such parts of the openings as are necessarily open for traffic purposes.

SECTION 1208. ROOFS AND SKYLIGHTS OF ADJOINING BUILDINGS.

When a building or structure is to be carried above the roof of an adjoining building, protection for the skylights and roof of such adjoining building shall be provided, at his own expense, by the person constructing or causing the construction of such build-

ing or structure; provided that if the owner, lessee or tenant of the adjoining building should refuse permission to have the roofs and skylights protected, the responsibility and expense for the necessary protection shall devolve on the person refusing such permission.

SECTION 1209. STAIR FACILITIES.

1209.1. Temporary stairs.

When the construction of a building has progressed to a height exceeding 60 feet above grade or when a building exceeding 60 feet in height is undergoing alterations, unless one or more permanent stairways have been installed, at least one temporary stairway shall be provided, continued in height as rapidly as the work progresses to the highest floor that has been installed, and maintained in serviceable condition until a permanent stairway has been completed

1209.2. Ladders.

Until either permanent or temporary stairways are installed, suitable substantial ladders securely fastened at top and bottom, shall be provided and maintained to provide means of reaching the various levels.

SECTION 1210. FIRE PROTECTION.

1210.1. Reinforced concrete construction.

In every building of reinforced concrete construction, forms of combustible material shall be stripped from the concrete and removed from the building as soon as practicable.

1210.2. Standpipes.

In all buildings in which standpipes are required by section 809, such standpipes shall be installed as the construction progresses, in such a manner that they are always ready for fire department use to the topmost floor that has been installed. Such standpipes shall be provided with a fire department connection on the outside of the building at the street level, and with one outlet at each floor. All outlets, connections and fittings shall be designed to fit the fire department equipment.

1210.3. Fire extinguishers.

(a) In every building operation wherever a tool house, store-room or other shanty is placed, or a room or space is used for storage, dressing room or workshop, at least one approved hand pump tank or portable chemical extinguisher of nonfreezing type or protected against freezing shall be provided and maintained in an accessible location.

(b) When a water supply of not less than 100 gallons per minute at 25 pounds nozzle pressure, ready for use at all times, is installed as the building operation progresses, a small hose, 50 feet in length, with a ½-inch nozzle, may be substituted for each such fire extinguisher.

1210.4. Access to fire extinguishing equipment.

During building operations, free access from the street to fire hydrants, and to outside connections for standpipes, sprinklers or other fire extinguishing equipments, whether permanent or temporary, shall be provided and maintained at all times. No material or construction equipment shall be placed within 10 feet of such hydrant or connection, nor between it and the center line of the street.

SECTION 1211. HEATING.

1211.1. Permanent heat.

The permanent heating equipment shall be installed and put in operation as soon as practicable.

1211.2. Temporary heat.

(a) When salamanders or other temporary heating devices are used, if a temporary heating plant is impracticable and until a permanent heating plant is installed, they shall not be set on combustible flooring or platforms unless thoroughly insulated therefrom by a bed of sand or cold ashes not less than 4 inches thick, or by other efficient protection, extending at least 2 feet horizontally beyond such devices on all sides. The legs of such devices, which shall be at least 12 inches long, shall rest on the insulation and shall not extend through it.

(b) Such devices shall be so located that there is a clearance of not less than 6 feet above nor less than 2½ feet on all sides, between such device and unprotected woodwork or combustible material, equipment or construction. Nor shall such devices be placed within 10 feet in any direction of tarpaulins or canvas covers, except as such tarpaulins or covers are flameproofed in an approved manner.

(c) Salamanders and similar heating devices shall be of a substantial type with protective screen covers, and shall be under constant supervision so long as they are in use.

SECTION 1212. WELDING AND CUTTING.

1212.1. Protective shield.

When gas cutting is done within 25 feet of combustible material, or when any welding or cutting is done above combustible material or above a place where workers are employed or where

persons are likely to pass, noncombustible shields shall be interposed to protect such materials and persons against sparks, and hot metal or slag.

1212.2. Welding equipment.

Welding equipment including but not limited to such items as regulators, torches and hoses, when not attached to cylinders ready for use, shall be stored in clean locations away from grease, oil and excessive heat.

1212.3. Cylinders for oxygen and fuel gases.

(a) Oxygen and fuel gas cylinders, unless secured on a special truck, shall not be moved unless the cylinder caps, if provided for in the cylinder design, are in place nor shall cylinders be stored without the caps in place.

(b) Suitable cradles shall be used for lifting or lowering oxygen or fuel gas cylinders. Ordinary rope slings or electromagnets shall not be used.

(c) Cylinders shall be placed away from the welding position so that they will not be unduly heated by radiation from heated materials, by sparks or slag, or by misdirection of the torch flame.

(d) Cylinders shall be stored away from combustible materials and in locations where they are not liable to excessive rise in temperature, physical damage or tampering.

(e) Closed spaces shall be ventilated properly while welding or cutting is being done therein.

1212.4. Oxygen equipment.

Oxygen cylinders, valves, regulators, hose and other apparatus and fittings shall be kept free from oil or grease.

1212.5. Acetylene.

Under no circumstances shall acetylene gas be brought in contact with unalloyed copper except in a blowpipe or torch.

1212.6. Cutting steel.

Before steel beams or other structural shapes or elements of construction are severed by flame cutting or other means, they shall be secured by ropes or chains to prevent dropping or swinging.

1212.7. Protective equipment.

Welders and cutters shall be protected from the rays of the arc or flame and from hot metal and other proper clothing and by helmets, hand shields or goggles equipped with suitable filter lenses.

SECTION 1213. STORAGE OF MATERIAL.**1213.1. Within building.**

Materials or equipment needed in a building operation, if stored within the building, shall be so placed that they will not load any part of the construction in excess of the design load, nor interfere with the safe prosecution of the work.

1213.2. Outside building.

(a) Materials and equipment shall not be stored in a street, alley, sidewalk or any other public space except by special permission of the municipality.

(b) In whatever manner building material may be stored or equipment set up in a street, a safe walkway not less than 4 feet wide, unobstructed for its full length and adequately lighted at all times shall be maintained for use of the public.

1213.3. Covering material.

Materials stored within the building or within 10 feet of the building which require covering shall be protected by noncombustible material.

SECTION 1214. DISPOSAL OF WASTE.

Waste material and rubbish shall not be stored nor allowed to accumulate within the building or in the immediate vicinity, but shall be removed from the premises as rapidly as practicable. No material shall be disposed of by burning on the premises or in the immediate vicinity without permission from the municipality. Dry material or rubbish shall be wetted down, if necessary, to lay dust or prevent being blown about.

SECTION 1215. WARNING LIGHTS.

All pits, excavations, fences, barriers, builder's equipment, building materials or rubbish in or upon a street, alley, sidewalk or any other public space, shall have placed upon or by them, illuminated lamps with red globes, flares or other approved lights, in such manner that there shall be one light at each end, and at intermediate points as may be necessary to afford proper warning after darkness.

SECTION 1216. LIGHTING.

All parts of buildings or structures under construction and all sheds, scaffolds and other equipment in connection therewith, where work is being performed or persons must necessarily pass, shall be adequately lighted to insure safety.

SECTION 1217. TEMPORARY WIRING.

Transformers, wiring, equipment and over current protection shall be installed in accordance with accepted practice.

SECTION 1218. SANITATION.

Until permanent provision is made, every building or structure in the course of erection, alteration, repair or demolition shall be provided with suitable and adequate toilet and drinking water facilities.

SECTION 1219. ACCIDENTS.**1219.1. First aid.**

On every building operation, a first aid cabinet containing, among other things, a supply of iodine or mercurochrome and aseptic gauze bandages shall be provided and maintained.

1219.2. Medical attention.

Arrangements shall be made for prompt medical attention in case of need.

SECTION 1220. DEMOLITION.**1220.1. Procedure.**

Except where there is adequate space and special permission has been received from the building official in the demolition of buildings other than buildings of wood frame construction, one story at a time shall be completely removed. No wall, chimney, or other construction shall be allowed to fall in mass on an upper floor. Bulky material, such as beams and columns, shall be lowered and not allowed to fall.

1220.2. Chutes.

(a) Chutes for the removal of materials and debris shall be provided in all such parts of demolition operations that are more than 20 feet above the point where the removal of material is effected.

(b) Such chutes shall be completely enclosed. They shall not extend in an unbroken line for more than 25 feet, but shall be equipped at intervals of 25 feet or less with substantial stops to prevent descending material from attaining dangerous speeds.

(c) The bottom of each chute shall be equipped with a gate or stop, with suitable means for closing or regulating the flow of material.

ARTICLE XIII.

ELEVATORS, DUMBWAITERS, MOVING STAIRWAYS
AND AMUSEMENT DEVICES.

SECTION 1300. GENERAL.

Elevators, dumbwaiters, moving stairways and amusement devices shall be constructed, installed and maintained in accordance with nationally recognized good practice on matters not covered in this code.

SECTION 1301. DESIGN AND EQUIPMENT OF ELEVATORS.

1301.1. Carrying capacity.

(a) Elevators shall be designed to sustain safely in all parts the rated load of the elevator.

(b) The safe carrying capacity of elevators shall be conspicuously placed inside the car.

1301.2. Speed safety device.

Power elevator cars suspended by wire ropes shall be equipped with a safety device capable of stopping and sustaining the car and its rated load whenever the speed exceeds a predetermined value. Hand elevators having a travel of over 15 feet shall be provided with a car safety of the instantaneous type operated as a result of the breaking or slackening of the suspension members. Car safeties of sidewalk elevators having a travel of 15 feet or less are not required to be operated by speed governors.

1301.3. Car and door interlocks.

Power elevators shall be equipped with a device that will automatically prevent operation of the driving machine by the normal operating device unless every hoistway door is locked in the closed position and unless the car door or gate is in the closed position. Such a device is not required for:

(1) Horizontally hinged doors or vertically lifting covers of sidewalk elevators located in sidewalks or other areas exterior to the building; or

(2) Landing doors at the bottom terminal landing of sidewalk elevators; or

(3) Freight elevators having a rise of 15 feet or less and equipped with vertically sliding manually operated hoistway doors.

1301.4. Terminal stopping devices.

Elevators, except hand elevators, shall be equipped with terminal stopping devices that will stop the car before it strikes the structural members overhead or fully compresses the buffer.

1301.5. Emergency exit.

Passenger elevator cars including existing passenger elevator cars shall be provided with an emergency exit at the top of the car. The exit opening shall be not less than 400 square inches in area with no dimension less than 16 inches.

1301.6. Lighting.

All elevator cars including existing elevator cars shall be so lighted when in service that the illumination at the landing edge of the car platform, when the car and landing doors are open, shall be not less than 5 foot-candles for passenger elevators and $2\frac{1}{2}$ foot-candles for freight elevators.

SECTION 1302. DESIGN AND EQUIPMENT OF MOVING STAIRWAYS.

(a) Moving stairways shall be designed to safely support in all parts the rated load of the moving stairway and shall be marked by the manufacturer with the rated load and the speed.

(b) Moving stairways shall be of noncombustible material throughout except for handrails and step wheels.

(c) Moving stairways shall have an angle of inclination not to exceed 30 degrees with the horizontal and shall have widths not less than 22 inches nor more than 48 inches measured at a point 27 inches vertically above the nose line of the steps. The moving stairways shall have solid balustrades with no depressed or raised paneling on the step side except for protective moldings properly beveled and projecting not more than $\frac{1}{4}$ inch. Treads and landings shall have a surface designed to limit the danger of slipping thereon.

(d) Moving stairways shall be provided with emergency stop switches, broken step-chain devices and, where a chain is used to connect the driving machine to the main drive shaft, with a broken drive chain device. The application or operation of any of these devices shall disconnect the power from the driving machine and cause the application of the brake to stop the moving stairway.

(e) Moving stairways considered as exit stairways and enclosures of moving stairways shall comply with Article VI in addition to the following:

(1) No single moving stairway flight shall have a vertical travel of more than 2 stories or 35 feet.

(2) Landings shall be provided at the top and bottom of moving stairways as required by section 604.7(b) for interior stairways.

SECTION 1303. RIDING ON FREIGHT ELEVATORS RESTRICTED.

Freight elevators shall not carry persons other than the operator and those necessary to handle freight. This shall not be construed to prohibit the carrying of freight on a passenger elevator. Freight elevators shall have a sign posted conspicuously thereon as follows: **PASSENGERS ARE FORBIDDEN TO RIDE ON THIS ELEVATOR.**

SECTION 1304. AMUSEMENT DEVICES.

Amusement devices shall be equipped with safety clutches. The cars or receptacles which persons are permitted to occupy shall have hand rails of sufficient number and height, or other approved appliances or safeguards, to prevent persons from being thrown therefrom or coming in contact with structural members.

SECTION 1305. CERTIFICATE.

1305.1. Required.

It shall be unlawful for the owner to operate or permit the operation or use of a passenger elevator, freight elevator, power operated dumbwaiter, moving stairway or amusement device until a certificate shall have been obtained from the building official.

1305.2. Issuance.

The building official shall, within a reasonable time after being requested to do so, inspect and test the equipment for which a certificate is required and if the same is found to be safe and in conformity with the provisions of this code, shall issue the certificate.

1305.3. Temporary permission to use.

Nothing herein contained shall prevent the temporary use by special permission of the building official of an elevator or moving stairway during construction; provided a notice is conspicuously posted on or in connection with such elevator or moving stairway to the effect that such elevator or moving stairway has not been officially approved.

SECTION 1306. INSPECTION.

1306.1. When required.

(a) The building official shall make or cause to be made an inspection and test of every power passenger elevator and mov-

ing stairway including existing power passenger elevators and moving stairways, at least once in every 6 months, and of every power freight and hand elevator and every amusement device, including existing power freight and hand elevators and existing amusement devices, at least once in every 12 months.

(b) Seasonal amusement devices which have been out of use for a period exceeding 30 days shall not be operated again until reinspected by the building official.

1306.2. Notice of repairs.

(a) In case defects exist which make the continued use of an elevator, moving stairway or amusement device unsafe the building official shall notify in writing the owner or person in control of such elevator, moving stairway or amusement device and its use shall cease. It shall not be used again until a reinspection has been made after necessary repairs and a new certificate has been issued.

(b) Upon notice from the building official repairs found necessary to an elevator, moving stairway or amusement device shall be made without delay by the owner or person in control of such elevator, moving stairway or amusement device.

1306.3. Certification.

After every inspection which shows an elevator, moving stairway or amusement device to be safe and in conformity with the requirements of this code the building official shall issue a certificate to that effect.

SECTION 1307. ACCIDENTS.

1307.1. To be reported.

The owner or person in control of an elevator, moving stairway or amusement device shall promptly notify the building official of each accident to a person requiring the service of a physician or disability exceeding one day or damage exceeding \$100 to apparatus on, about or in connection with such elevator, moving stairway or amusement device, and shall afford him every facility for investigating such accident and the damage resulting therefrom.

1307.2. Investigation.

The building official shall make or cause to be made an investigation and shall place on file in his office a full report of such investigation. Such report shall give in detail all material facts and information available and the cause or causes so far as they can be determined, and shall be open to public inspection at all reasonable hours.

1307.3. Operation discontinued.

When an accident involves the failure or destruction of a part of the construction or of the operating mechanism, the elevator, moving stairway or amusement device shall not be used again until it has been made safe. The building official may order the discontinuance of the elevator, moving stairway or amusement device until a new certificate has been issued.

1307.4. Removal of parts restricted.

No part of the damaged construction or operating mechanism shall be removed from the premises until permission has been granted by the building official.

SECTION 1308. FIRE DEPARTMENT USE.

In buildings equipped with more than one elevator, at least one elevator shall be kept in readiness at all times for fire department use.

ARTICLE XIV.

GAS PIPING AND PLUMBING.

SECTION 1400. GAS PIPING.

1400.1. Installation.

Piping for any and all types of gas used for fuel or lighting purposes in buildings and structures shall be installed to conform with nationally recognized good practice on matters not covered in this code.

1400.2. Inspection.

No person shall use or permit the use of a new system or an extension of an old system of gas piping in a building or structure before the same has been inspected and tested to insure the tightness of the system, and a certificate has been issued by the building official.

1400.3. Certificate.

The building official shall, within a reasonable time after being requested to do so, inspect and test a system of gas piping that is ready for such inspection and test, and if the work is found satisfactory and the test requirements are complied with, he shall issue the certificate.

1400.4. Supplying gas.

It shall be unlawful to supply gas to a system of gas piping in a building or structure before the required certificate has been issued, except that the building official may give temporary permission for a reasonable time to supply and use gas before such installation has been fully completed and the certificate issued.

1400.5. Existing work.

Nothing herein shall prohibit the continued use of existing systems of gas piping without further inspection or test, unless the building official has reason to believe that defects exist which make the system dangerous to life or property.

SECTION 1401. PLUMBING.

1401.1. Installation.

The plumbing and drainage system of a building or structure shall be installed to conform with nationally recognized good practice on matters not covered in this code.

1401.2. Water supply.

(a) Every building in which people live, work or congregate shall be provided with ample water supply installed and maintained in a satisfactory working condition.

(b) In every multifamily house there shall be in each dwelling unit at least one kitchen sink with running water and waste connection. The space underneath such sink shall be accessible.

1401.3. Toilet facilities.

(a) In every building, including existing buildings not already supplied, where there is human occupancy or employment, there shall be a sufficient number of suitable and convenient water closets, properly connected with the drainage system.

(b) In dwellings and multifamily houses there shall be at least one separate water closet within each dwelling unit.

1401.4. Toilet rooms.

(a) Water closets and urinals shall be placed in rooms or compartments which are devoted exclusively to toilet facilities.

(b) The partitions enclosing toilet rooms shall be solid, except for the entrance door, and shall extend from the floor to the ceiling. Partitions separating water closets or urinals within a toilet room shall not extend to the ceiling but shall be so constructed as to permit circulation of air throughout the toilet room.

1401.5. Inspection and tests.

All piping, traps and fixtures of a plumbing system shall be inspected by the building official or his representative and tested in his presence. The building official shall be notified in advance of the time of inspection before any concealed piping or traps are covered up and when the completed installation is ready for final inspection.

1401.6. Certificate.

The certificate of occupancy required by this code shall not be issued by the building official until the plumbing and drainage of the building has been inspected and tested and a certificate has been issued by the official having jurisdiction.

ARTICLE XV.

ELECTRICAL INSTALLATIONS.

SECTION 1500. CONFORMANCE.

No electric wiring for light, heat or power shall be installed in a building or structure, nor shall an alteration or extension of an electric wiring system be made, except in conformity with the provisions of this article.

SECTION 1501. INSTALLATION AND APPROVAL OF MATERIALS.

1501.1. Installation.

Electric wiring systems shall be installed in accordance with nationally recognized good practice on matters not covered in this code.

1501.2. Approval of materials, fittings and devices.

Only approved materials, fittings and devices shall be used in electric wiring systems.

SECTION 1502. INSPECTION.

1502.1. During installation.

(a) The building official shall, during the installation of an electric wiring system, make inspections to assure compliance with this code.

(b) No work in connection with an electric wiring system shall be covered or concealed until it has been inspected as prescribed in this section and permission to do so has been given by the building official.

1502.2. On completion of work.

The building official shall, within a reasonable time after notice of the completion of electrical wiring, for which a permit is required by this code, make an inspection of such work and such tests as may be necessary to determine that it conforms with this code.

1502.3. Reinspection.

(a) The building official shall make a reinspection of an electric wiring installation whenever he deems it necessary in the interest of public safety.

(b) If an electric wiring system upon reinspection is found to be defective and unsafe, the building official shall revoke all certificates, in effect at that time, relating to such system; and

the use of such system shall be discontinued until it has been made to conform to this code and a new certificate has been issued by the building official.

SECTION 1503. CERTIFICATE.

Upon the filing of his report, or the report of the person authorized by him to make the inspection, that an electric wiring system is lawfully installed or altered, the building official shall issue a certificate.

SECTION 1504. SUPPLYING CURRENT.

1504.1. Restriction.

It shall be unlawful to use or permit the use of, or to supply current for, electric wiring for light, heat or power in a building or structure, unless the required certificate of inspection and approval has been issued.

1504.2. Temporary current.

The building official may give temporary permission for a reasonable time, to supply and use current in part of an electric installation before such installation has been fully completed and the certificate issued.

ARTICLE XVI.

SIGNS AND OUTDOOR DISPLAY STRUCTURES.

SECTION 1600. GENERAL.

1600.1. Permit.

(a) Except as otherwise provided in section 1600.3, no display sign shall be erected, or attached to, suspended from or supported on a building or structure until a permit for the same has been issued by the building official.

(b) No permit for a display sign shall be issued until the bond required in section 1600.2 has been filed.

1600.2. Bond.

The owner or persons in control of a display sign suspended over a street or extending into a street more than 15 inches beyond the building line shall execute a bond in a sum to be fixed by the official having control over streets, with sureties approved by such official, indemnifying the municipality against all loss, cost, damage or expense incurred or sustained by or recovered against the municipality by reason of the construction or maintenance of such display sign.

1600.3. Exemption.

No permit shall be required for a wall sign not more than 10 square feet in area; nor for a projecting sign not exceeding 2½ square feet of display surface; nor for a ground sign advertising either the sale or rental of the premises upon which it is maintained when such sign does not exceed 25 square feet of display surface. However, the exemption from a permit shall not be construed as relieving the owner or person in control of the sign from erecting and maintaining the sign in a safe condition.

SECTION 1601. ALTERATIONS.

1601.1. Structural.

No display sign shall be altered, rebuilt, enlarged, extended or relocated except in conformity with the provisions of this article.

1601.2. Movable parts.

The changing of movable parts of signs that are designed for changes, or the repainting of display matter shall not be deemed to be alterations within the meaning of this section.

SECTION 1602. CONSTRUCTION.

1602.1. Wall signs.

(a) Display signs placed against the exterior walls of buildings or structures shall not extend more than 15 inches out from the wall surface.

(b) Wall signs shall not extend beyond the top or ends of the wall surface on which they are placed.

(c) Wall signs exceeding 40 square feet in area shall be of noncombustible material except that such signs placed against a building or structure which is of wood frame construction or which could be of wood frame construction under this code may be of combustible material. Cappings, decorations, lettering and mouldings may be of combustible material on any wall sign.

(d) Wall signs shall be securely attached to the building or structure by means of metal anchors, bolts or expansion screws. No wood blocks or anchorage with wood used in connection with screws or nails shall be considered proper anchorage, except in the case of wall signs attached to buildings or structures with walls of wood. No wall sign shall be entirely supported by an unbraced parapet wall.

1602.2. Projecting signs.

(a) No projecting sign shall project from the face of the building or structure over a street, alley or other public space beyond a line drawn perpendicularly upward from 2 feet inside the curb line.

(b) A clear space of not less than 9 feet shall be provided below all parts of projecting signs.

(c) Projecting signs exceeding 2½ square feet in area shall be made of noncombustible material except that decorations, facings and lettering set in or attached to noncombustible material may be of combustible material.

(d) Projecting signs shall be securely attached to the building or structure by bolts, anchors, chains, rods or guys. No nails or staples shall be used to secure any projecting sign to a building or structure.

1602.3. Ground signs.

(a) Ground signs shall not exceed 40 feet in height above the ground on which they rest. The height shall be measured to the top of the sign.

(b) Lighting reflectors may project beyond the top or face of the sign.

(c) An open space at least 30 inches high shall be maintained between the bottom of the sign and the ground; provided that necessary supports extending through such space, and the filling of such space with lattice or slats leaving at least 50 per cent of the space open shall not be prohibited.

(d) Within the fire limits, ground signs more than 15 feet high shall be made of noncombustible material, except that cappings, decorations, lettering and mouldings may be of combustible material.

1602.4. Roof signs.

(a) Display signs that are placed above or supported on the top of a building or structure shall be made of noncombustible material, except that cappings, decorations, lettering and mouldings may be of combustible material.

(b) An open space of not less than 4 feet shall be maintained below the bottom of the sign, except for necessary vertical supports.

1602.5. Location.

No sign shall be so placed as to obstruct or interfere with an exit way required by sections 602 and 603, or so as to prevent free passage from one part of a roof to any other part thereof, or so as to interfere with light and ventilation required by Article V, or so as to obstruct any opening in an exterior wall required in this code for fire department access.

1602.6. Design.

(a) All signs shall be designed according to generally accepted engineering practice to withstand wind pressures specified in this section. The loads shall be distributed to the structural members of the building or structure in such a way that these members will not be overstressed.

(b) For the purpose of determining wind pressures all signs shall be classified as either open or solid. Signs in which the projected area exposed to wind consists of 70 per cent or more of the gross area as determined by the over-all dimensions shall be classed as solid signs; those in which the projected exposed area is derived from open letters, figures, strips, and structural framing members, the aggregate total area of which is less than 70 per cent of the gross area so determined, shall be classed as open signs.

(c) All signs shall be designed and constructed to withstand wind pressures applied to the projected exposed area, allowing for wind in any direction, in accordance with the following table:

Height from ground to top of sign, in feet	Wind pressure, pounds per square foot	
	Solid signs	Open signs
Less than 30	17	23
30- 49	22	31
50- 99	28	39
100-499	33	46

For ground signs 30-49 feet in height the tabular values for heights of less than 30 feet may be used.

ARTICLE XVII.**SAFETY TO LIFE REQUIREMENTS FOR EXISTING BUILDINGS.****SECTION 1700. CERTIFICATE OF OCCUPANCY.**

Upon written request from the owner, the building official shall issue a certificate of occupancy for an existing building, after verification by inspection, provided that at the time of issuing such certificate there are no violations of law or orders pending.

SECTION 1701. DETERMINING AND POSTING OF FLOOR LOADS.

In every existing building used for business, industrial, mercantile or storage occupancy, in which heavy loads or concentrations occur or machinery is introduced, the owner or occupant shall cause the weight that each floor will safely sustain to be estimated by a competent person and filed with the building official, and when accepted by him posted as required for new buildings by section 902.9.

SECTION 1702. INTERIOR FINISH.

Within a reasonable time, as fixed by a written order of the building official, the interior finish of every existing building shall comply with section 808 in the areas and spaces where that section requires the interior finish to have a flame spread rating of not over 75; and when, in the opinion of the building official, the flame spread rating of interior finish in existing areas and spaces used for assembly or educational occupancies is of such magnitude as to present a hazard to life safety, he may order such interior finish to comply with section 808.

SECTION 1703. ROOF COVERING REPAIRS.

(a) No roof covering on an existing roof shall be renewed or repaired to a greater extent than 1/10 of the roof surface, except in conformity with the requirements of section 802.

(b) The placing of new roof covering conforming to section 802 over existing combustible roof covering shall not be prohibited; provided the existing roof covering is removed for a distance of 4 inches along all edges of the roof and replaced by strips of weatherproof material over which the new roof covering shall extend.

SECTION 1704. CHIMNEYS AND VENTS.

(a) All existing masonry chimneys which upon inspection by the building official are found to be without flue liner and with open mortar joints which will permit smoke or flame to be discharged into the building or which are cracked as to be dangerous shall be made safe by means of a standard flue liner or with a corrosion resistant metal pipe one inch less in diameter than the interior of the chimney with the entire annular space between the metal pipe and the walls of the chimney filled with a cement mortar and otherwise repaired if necessary or they shall be removed.

(b) Existing chimneys and vents of metal which are corroded or improperly supported shall be replaced, unless suitable repairs are made.

SECTION 1705. HEAT PRODUCING APPLIANCES.

In case the installation of an existing heat producing appliance, heating, ventilating, air conditioning, blower or exhaust system does not conform to the code requirements for new installations, the building official may order such changes in the installation as may be necessary to remove existing fire hazards.

SECTION 1706. MEANS OF EGRESS.

1706.1. General.

Within a reasonable time, as fixed by a written order of the building official, every existing building shall be provided with exit facilities adequate for the safety of the occupants. Such exit facilities shall be as approved by the building official, but shall not provide less safety to the occupants than that obtained by compliance with the provisions of this section. This section shall not apply to dwellings or farm buildings.

1706.2. Number and location of exit ways.

(a) Every story for 50 or more occupants as determined by section 601.2 shall have at least 2 separate exit ways (as defined in section 601.1) except that in any building of fire-resistive construction, and in any building of other types of construction not over 2 stories in height, and in any sprinklered building, a single exit way may be used for stories having less than 100 occupants, provided the stairway and other floor openings are enclosed with an enclosure having a fire resistance rating of not less than one hour, with all openings therein protected as required for such enclosure in section 1706.8.

(b) The number and location of exit doorways shall be such that the maximum distance from any point in a floor area, room or space to an exit doorway, measured along the line of travel, does not exceed: 100 feet for high hazard occupancies; 125 feet for

educational, industrial, institutional, mercantile, residential and storage occupancies; 150 feet for assembly and business occupancies. Where a floor area is subdivided into smaller areas such as rooms in hotels, multifamily houses and office buildings the distance to an exit doorway shall be measured from the corridor entrance of such rooms. Where the building is sprinklered, or is of fire-resistive construction, or is of noncombustible construction occupied exclusively by stocks of noncombustible material not packed or crated in combustible material, the above distances to an exit doorway may be increased 50 per cent.

(c) In multifamily houses having more than one dwelling unit above the second story, every dwelling unit shall have access to at least two exit ways. Such exit ways may use common or communicating corridors or hallways, but the two required exit ways from any one dwelling unit shall not use a common interior stairway.

(d) Every room used as a place of assembly shall have at least two doorways complying with section 609 and which open onto an exit way, except that for such rooms located on the first or grade floor a single such doorway may be used for an occupancy not in excess of 200 occupants provided the doorway has a clear width of not less than 44 inches.

(e) Every place of assembly having a capacity greater than 200 occupants shall have exit ways conforming as to number and width with sections 602.6(b) and 604.5. In applying section 604.5 a stairway 40 inches wide may be accepted as two units.

(f) Institutional occupancies shall be provided with at least two exit ways in accordance with section 602.4.

1706.3. Minimum requirements for existing exit stairways.

(a) The stairways in one of the required exit ways from any story or stories occupied by a total of 6 or more persons shall have treads not less than 7 inches in width and risers not higher than 9½ inches nor more than 1.2 times the width of tread. Winder treads shall have a width of not less than 6 inches measured one foot from the narrow end. This paragraph shall not be construed as modifying the pitch and tread requirements for any new stairway construction.

(b) All exit stairs shall be guarded at the sides by well secured balustrades or other acceptable guards wherever such are needed for the safety of users, and shall have a handrail on at least one side.

1706.4. Fire escapes.

Exterior fire escapes on existing buildings used for educational, institutional or theatre occupancies shall conform to the requirements for exterior stairways in section 606 when they are constructed or altered to comply with this section 1706; exterior

fire escapes on other buildings shall conform to the following minimum requirements:

(a) They shall be constructed of noncombustible materials, except on buildings of wood frame construction or on buildings of ordinary construction not over three stories in height.

(b) They shall be constructed with stairs not less than 22 inches wide between rails, having risers not higher than 9 inches and having treads not narrower than 6 inches. Ladders may be used from the upper landing of a fire escape to the roof.

(c) Unless the stair leading to the ground at the foot of the fire escape is permanently fixed, it shall be constructed with counter-balancing devices that permit it to be easily and quickly released and placed in rigid position for use.

(d) They shall be of sufficient strength to sustain a live load of 100 pounds per square foot or concentrated loads of 300 pounds, placed upon an area of $2\frac{1}{2}$ feet square and so located as to produce maximum stress conditions.

(e) They shall be so placed that they can be readily and safely reached by the occupants of the building.

(f) They shall be so located that safe egress will be provided at the foot either directly or through an enclosed exit way to a street or to an open space that communicates with a street.

(g) They shall be spacious enough that the movements of those using the fire escape will not be retarded.

(h) All balconies and stairs shall be provided with substantial guard railings at least 4 feet high, without any openings greater than 8 inches in width, except that for buildings not over 5 stories high, triple guard rails equally spaced, with top rail not less than 42 inches high may be used. (Height for stairs is to be measured at center of tread.) The landings, platforms, and the treads of all stairs shall be so designed that the accumulation of snow and ice will be reduced to a minimum.

(i) Except on buildings not exceeding 3 stories in height and on buildings of wood frame construction, all doors opening on or within 10 feet of the fire escape shall be approved self-closing fire doors, and any windows opening on or within 10 feet of the fire escape shall be approved fire windows; provided that where the occupancy inside these windows or doors is such as to present a light fire hazard or is sprinklered, or the overall exit arrangements are such that this protection is of minor importance, the building official may waive this requirement.

1706.5. Spiral slide or tubular fire escapes.

Slide type fire escapes installed to provide additional means of egress from existing buildings shall be of approved type and conform to the following:

(a) They shall not be used to provide means of egress from buildings exceeding 70 feet or 6 stories in height. The pitch and design shall be such that a person using the chute will be discharged without injury. Doors at the entrance to the chute shall have approved panic bar releases and shall swing with the exit travel and be so installed that they will not obstruct the use of the chute. If doors are installed at the lower end of the chute, they shall be equipped with a releasing device on the inside such as a kick plate.

(b) All sheet metal used for the chute shall be corrosion resistant, shall not be painted on the inside and shall be maintained so as to be free from rust. Any part of the chute with which the user may come in contact shall be free from cracks, crevices, or any projection or roughness which may cause injury or reduce the effectiveness of the chute.

(c) All chutes shall be of sufficient size and ample strength and be supported in a substantial manner.

1706.6. Vertical openings which shall be protected.

All interior stairways, including moving stairways and elevators, shall be enclosed or their floor openings otherwise protected, in accordance with sections 1706.7 and 1706.8, except that stairways and elevators as follows shall be exempt from such requirements:

(1) Stairways and elevators which are not required to be enclosed in new construction. See sections 604-2(d) and 804.1.

(2) Stairways and elevators in buildings of other than institutional occupancy, not over 2 stories in height.

(3) Stairways and elevators in buildings of other than institutional occupancy, not over 4 stories in height, where the stories above the second are used for storage only.

(4) Stairways and elevators in sprinklered buildings of residential, mercantile or business occupancy not over 4 stories in height.

(5) Stairways and elevators in sprinklered buildings of storage occupancy of any height.

1706.7. Required protection for vertical openings.

(a) Except as provided in paragraphs (b) and (c) below, required enclosures for vertical openings shall have a fire resistance rating of not less than one hour. In buildings of fire-resistive construction such enclosures shall consist of noncombustible materials.

(b) In any building of fire-resistive construction, or of other types of construction not over 4 stories high, and in any sprinklered building, required enclosures may be constructed of 3/4-inch

gypsum plaster on metal lath on each side of studs, or equivalent, or of wired glass in metal framework.

(c) In any building not over 4 stories high and in any sprinklered building, existing enclosures or parts thereof constructed of plaster on wood lath or equivalent, and in good repair, may be continued in use provided they are effectively firestopped at the basement ceiling.

(d) An enclosure required by this section may include both elevators and stairs but two or more separate stairways shall not be in a single enclosure.

(e) In lieu of a full enclosure, stairways, including moving stairways, may be protected with an enclosure at the head or at the foot of each stairway from one floor to another. The construction of such enclosures shall be in accord with the requirements of paragraphs (a), (b) and (c) above.

(f) In lieu of an enclosure, floor openings for elevators in industrial occupancies may be protected by substantial guards or gates with approved trap doors at each floor opening. Such trap doors shall be constructed to form a substantial floor surface when closed, and arranged to open and close by action of the elevator in ascending or descending. The guards or gates and trap doors shall be kept closed when the shaftway is not in use.

1706.8. Door and window openings in required enclosures for vertical openings.

(a) All openings in required enclosures for vertical openings except window openings to the exterior of the building, shall be protected with doors in accordance with the following paragraphs. Movable transoms in such enclosures are prohibited.

(b) Doors in such enclosures shall be metal doors or metal covered doors or solid wooden doors of the flush type of not less than 1¾-inch nominal thickness, except that existing doors in acceptable existing enclosures or parts thereof in any building not over 4 stories high and in any sprinklered building, may be any substantial wood doors having any wood panels less than ½-inch thick covered on the side opposite the stair side with sheet steel of not less than 28 gauge, securely attached with bolts or screws. Any glass in doors or fixed transoms shall be wired glass.

(c) Doors in such enclosures, except doors opening into apartments, shall be self-closing.

1706.9. Path of exit travel from stairway to street.

(a) All interior stairways required to be enclosed shall lead directly or through an enclosed passageway to a street or to an open space that communicates with a street.

(b) The enclosure of such passageway shall conform to the requirements applying to the stair enclosure. The enclosure shall

separate from the exit way all basement occupancies, and all unsprinklered business and mercantile occupancies except those of a size and character which do not constitute a serious life hazard from fire, such as news stands, cigar stands, lunch counters and small offices.

1706.10. Exit doors.

(a) Doorways opening on to an exit stairway, street or to a court or open space communicating with a street, and serving as a required exit way for 50 or more occupants shall have the doors, including the doors of vestibules, so hung as to swing open in the direction of exit travel.

(b) All doors serving in a required exit way or leading to a required exit way from rooms occupied by 50 or more occupants and all doors serving in a required exit way or leading to a required exit way from places of assembly shall be hung to swing open in the direction of exit travel. Panic hardware shall be installed in accordance with section 609.4.

(c) Revolving doors shall be used in exit ways only under the conditions specified in section 609.3.

1706.11. Exit signs, lighting, and maintenance.

Exit ways shall be equipped with signs and be lighted and maintained in accordance with sections 501.12 and 610.

APPENDIX A

Standards and Publications Representing
Nationally Recognized Good Practice.

Below is given a partial list, as of October, 1955, of standards and publications on subjects normally covered in building codes. They have been prepared after much study and research by committees of men technically well qualified to fix these standards. They may be accepted as representing nationally recognized good practice, and materials and methods of construction conforming to them should be accepted as meeting the requirements of the National Building Code within the limitations and conditions inherent in the standards or fixed by the code.

For the convenience of users of the National Building Code, the standards and publications representing nationally recognized good practice are listed under the section number of the code to which the standards and publications apply.

The addresses of organizations issuing standards and publications listed below are as follows:

- ACI—American Concrete Institute**
18263 W. McNichols Rd., Detroit 19, Mich.
- AISC—American Institute of Steel Construction**
101 Park Avenue, New York 17, N. Y.
- AISI—American Iron and Steel Institute**
350 Fifth Avenue, New York 1, N. Y.
- AITC—American Institute of Timber Construction**
1757 K Street, N.W.—Suite 100, Washington 6, D. C.
- ASTM—American Society for Testing Materials**
1916 Race Street, Philadelphia 3, Pa.
- ASA—American Standards Association**
70 East 45th Street, New York 17, N. Y.
- AWS—American Welding Society**
33 West 39th Street, New York 18, N. Y.
- FPL—Forest Products Laboratory**
Madison 5, Wisconsin
- HHFA—Housing and Home Finance Agency**
Technical Office, Washington 25, D. C.
- NBFU—National Board of Fire Underwriters**
85 John Street, New York 38, N. Y.
222 West Adams Street, Chicago 6, Ill.
465 California Street, San Francisco 4, Calif.
- NFPA—National Fire Protection Association**
60 Batterymarch Street, Boston 10, Mass.
- NLMA—National Lumber Manufacturers Association**
1319 Eighteenth Street, N.W., Washington 25, D. C.
- SJI—Steel Joist Institute**
1346 Connecticut Avenue, N.W., Washington 6, D. C.
- U.L., Inc.—Underwriters' Laboratories, Inc.**
207 East Ohio Street, Chicago 11, Ill.
2550 Dundee Road, Box 247, Northbrook, Ill.
161 Sixth Avenue, New York 13, N. Y.
1655 Scott Lane, Santa Clara, Calif.

Section 314(a)

NBFU No. 30, Standards for the Storage, Handling and Use of Flammable Liquids.

NBFU No. 42, NFPA No. 42, Standards for the Storage, Handling and Use of Pyroxylin Plastic in Factories Making Articles Therefrom.

NBFU No. 43, NFPA No. 43, Standards for the Storage, Handling and Use of Pyroxylin Plastic in Warehouses and Wholesale Jobbing and Retail Stores.

NBFU No. 58, NFPA No. 58, Standards for the Storage and Handling of Liquefied Petroleum Gases.

NBFU No. 61B, NFPA No. 61B, Standard for the Prevention of Dust Explosions in Terminal Grain Elevators.

NBFU No. 61C, NFPA No. 61C, Standard for the Prevention of Dust Explosions in Flour and Feed Mills.

NBFU No. 64, NFPA No. 64, Standard for the Prevention of Dust Ignitions in Country Grain Elevators.

Section 319.6

NFPA No. 102, ASA Z20.3—1950, Standard for Places of Outdoor Assembly, Grandstands and Tents.

Section 708.5(a)

Performance Standards, June, 1947 of the HHFA.

Section 802.1

Roof coverings listed in U.L. Inc. Fire Protection Equipment List.

Section 809.4(a)

NBFU No. 14, NFPA No. 14, Standards for the Installation of Standpipe and Hose Systems.

Section 810.2(a)

NBFU No. 13, NFPA No. 13, Standards for the Installation of Sprinkler Systems.

Sections 905.1(a) and 908.1(a)

ASA A56.1-1952, Building Code Requirements for Excavations and Foundations.

Section 907.1

ASTM C34-52, ASA A74.1-1953, Specifications for Structural Clay Load-Bearing Wall Tile.

Section 908.2(a)

ASTM D25-54T, Specifications for Round Timber Piles.

Section 908.2(e)

Publications on the treatment of wood piles of the Forest Products Laboratory of the U. S. Department of Agriculture.

Section 908.3(a)

ASTM A252-54, Specifications for Welded and Seamless Steel Pipe Piles.

Section 908.5(a)

ASTM A7-53T, Specifications for Steel for Bridges and Buildings.

Section 909.1(c)

ASTM C5-26, Specifications for Quicklime for Structural Purposes.

ASTM C6-49, Specifications for Normal Finishing Hydrated Lime.

ASTM C10-54, Specifications for Natural Cement.

ASTM C22-50, ASA 49.1-1951, Specifications for Gypsum.

ASTM C33-54T, Specifications for Concrete Aggregates.

ASTM C34-52, ASA A74.1-1953, Specifications for Structural Clay Load-Bearing Wall Tile.

ASTM C52-54, Specifications for Gypsum Partition Tile or Block.

ASTM C55-52, ASA 75.1-1953, Specifications for Concrete Building Brick.

ASTM C56-52, ASA A76.1-1953, Specifications for Structural Clay Non-Load-Bearing Tile.

ASTM C57-52, ASA A77.1-1953, Specifications for Structural Clay Floor Tile.

ASTM C61-50, ASA 66.1-1951, Specifications for Keene's Cement.

ASTM C62-50, ASA A98.1-1953, Specifications for Building Brick (Solid Masonry Units Made from Clay or Shale).

ASTM C73-51, ASA A78.1-1952, Specifications for Sand-Lime Building Brick.

ASTM C90-52, ASA A79.1-1953, Specifications for Hollow Load-Bearing Concrete Masonry Units.

ASTM C91-53, ASA A1.3-1954, Specifications for Masonry Cement.

ASTM C94-54T, Specifications for Ready-Mixed Concrete.

ASTM C105-47, Specifications for Ground Fire Clay as a Mortar for Laying-Up Fireclay Brick.

ASTM C106-51, Specifications for Refractories for Incinerators.

ASTM C126-52T, ASA 101.1-1954, Specifications for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.

ASTM C129-52, ASA A80.1-1953, Specifications for Hollow Non-Load-Bearing Concrete Masonry Units.

ASTM C141-52, Specifications for Hydraulic Hydrated Lime for Structural Purposes.

ASTM C144-52T, Specifications for Aggregate for Masonry Mortar.

ASTM C145-52, ASA A81.1-1953, Specifications for Solid Load-Bearing Concrete Masonry Units.

ASTM C150-53, ASA A1.1-1954, Specifications for Portland Cement.

ASTM C161-44T, Specifications for Mortar for Reinforced Brick Masonry.

- ASTM C175-53, ASA A1.16-1954, Specifications for Air-Entraining Portland Cement.
- ASTM C205-53T, Specifications for Portland Blast-Furnace Slag Cement.
- ASTM C206-49, Specifications for Special Finishing Hydrated Lime.
- ASTM C207-49, Specifications for Hydrated Lime for Masonry Purposes.
- ASTM C212-54, Specifications for Structural Clay Facing Tile.
- ASTM C216-50, ASA A99.1-1953, Specifications for Facing Brick (Solid Masonry Units Made from Clay or Shale).
- ASTM C260-54, Specifications for Air-Entraining Admixtures for Concrete.
- ASTM C270-54T, Specifications for Mortar for Unit Masonry.
- ASTM C279-54, ASA A103.1-1954, Specifications for Chemical-Resistant Masonry Units.
- ASTM C287-54, Specifications for Sulfur Mortar.
- ASTM 315-53T, Specifications for Clay Flue Linings.
- ASTM C330-53T, Specifications for Lightweight Aggregate for Concrete Masonry Units.
- ASTM C340-54T, Specifications for Portland-Pozzolan Cement.

Section 909.12(c)

- ACI 318-51, ASA A89.1-1951, Requirements for concrete in Building Code Requirements for Reinforced Concrete.

Sections 913.1, 913.2(b) and 913.7(d)

- ACI 318-51, ASA A89.1-1951, Building Code Requirements for Reinforced Concrete.

Section 913.3(b)

- ASTM C33-54T, Specifications for Concrete Aggregates.
- ASTM C330-53T, Specifications for Lightweight Aggregates for Structural Concrete.
- ASTM C332-54T, Specifications for Lightweight Aggregates for Insulating Concrete.

Sections 913.4(a) and 914.3

- ASTM A7-53T, Specifications for Steel for Bridges and Buildings.
- ASTM A15-54T, Specifications for Billet-Steel Bars for Concrete Reinforcement.
- ASTM A16-54T, Specifications for Rail-Steel Bars for Concrete Reinforcement.
- ASTM A82-34, ASA A50.3-1936, Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement.
- ASTM A160-54T, Specifications for Axle-Steel Bars for Concrete Reinforcement.
- ASTM A185-54T, Specifications for Welded Steel Wire Fabric for Concrete Reinforcement.

ASTM A305-53T, Specifications for Minimum Requirements for the Deformations of Deformed Steel Bars for Concrete Reinforcement.

ASTM A377-54T, Specifications for Cast Iron Pressure Pipe.

Sections 914.1 and 914.2(b)

ASA 59.1-1954, Building Code Requirements for Reinforced Gypsum Concrete.

Sections 916.1, 916.3(b), (c) and (d) and 916.7(c)

ASA A57.1-1952, Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, AISC June, 1949.

Specifications for Assembly of Structural Joints Using High Strength Steel Bolts, AISC February, 1954.

Section 916.2

ASTM A7-53T, Specifications for Steel for Bridges and Buildings.

Section 916.10(d)

NBFU No. 51, NFPA No. 51, Gas Systems for Welding and Cutting.

AWS A6.1-55T, Recommended Safe Practices for Inert-Gas Metal-Arc Welding.

AWS D1.0-46, Standard Code for Arc and Gas Welding in Building Construction.

ASA Z49.1-1950, AWS Z49.1-50, Safety in Electric and Gas Welding and Cutting Operations.

Section 917(a)

Part III of the Light Gage Steel Design Manual, AISI January, 1949.

Section 917(c)

ASTM A245-52T, Specifications for Heavy Gage Structural Quality Flat Hot-Rolled Carbon-Steel Sheets.

ASTM A246-52T, Specifications for Light Gage Structural Quality Flat Rolled Carbon-Steel Sheets.

ASTM A303-52T, Specifications for Hot-Rolled Carbon-Steel Strip of Structural Quality.

Section 918.1

Standard Specifications for Open Web Steel Joist Construction Longspan Series, SJI April 28, 1953.

Standard Specifications for Open Web Steel Joist Construction Shortspan Series, SJI August 23, 1954.

Section 918.2

ASTM A7-53T, Specifications for Steel for Bridges and Buildings.

Grade C of ASTM A245-52T, Specifications for Heavy Gage Structural Quality Flat Hot-Rolled Carbon-Steel Sheets.

Grade C of ASTM A246-52T, Specifications for Light Gage Structural Quality Flat Rolled Carbon-Steel Sheets.

Grade C of ASTM A303-52T, Specifications for Hot-Rolled Carbon-Steel Strip of Structural Quality.

Sections 919.1 and 919.2(a) and (d)

National Design Specifications for Stress-Grade Lumber and Its Fastenings, NLMA 1954.

Timber Construction Standards, AITC 1954.

Section 921

ASA A42.1-1955, Specifications for Gypsum Plastering.

ASA A42.2-1946, Specifications for Portland Cement Stucco.

ASA A42.3-1946, Specifications for Portland Cement Plastering.

ASA A42.4-1955, Specifications for Interior Lathing and Furring.

Sections 1002.1, 1003.1 and 1004.1

Code for Heat Producing Appliances, Heating, Ventilating, Air Conditioning, Blower and Exhaust Systems, NBFU 1955.

Sections 1201.1 and 1204.1

ASA A10.2-1944, Safety Code for Building Construction.

Section 1300

ASA A17.1-1955, Safety Code for Elevators, Dumbwaiters and Escalators.

Section 1400.1

NBFU No. 54, NFPA No. 54, Standards for the Installation of Gas Piping and Gas Appliances in Buildings.

Section 1401.1

ASA A40.8-1955, National Plumbing Code.

Section 1501.1

NBFU No. 70, NFPA No. 70, ASA C1-1953, National Electrical Code.

APPENDIX B.

Occupancy Requirements.

Hazards to life and property from fire vary with the occupancy of a building or structure. To provide reasonable safety to life and property from fire, building codes must have provisions that pertain only to a specific occupancy or class of occupancy. Likewise they have exceptions to certain provisions for a specific occupancy or class of occupancy.

In order that persons using the National Building Code may have a guide to the sections of the code that pertain only to a specific occupancy or class of occupancy, there is given in the Index under the name of each occupancy classification a list of

the sections of the code pertaining particularly to them. In many cases the sections contain an exception for the occupancy.

The items listed in the Index should not be construed as containing all of the sections of the National Building Code that apply to an occupancy as, in general, all sections of the code apply. They should be thought of as emphasizing the sections containing requirements or exceptions peculiar to the occupancy under which the sections are listed. Used in this light they may be valuable in checking plans of proposed buildings or structures as they can serve as a guide to the user to be certain that the plans comply with all special provisions of the code.

APPENDIX C.

Inspected Appliances and Materials.

Once a year (with bi-monthly supplements) Underwriters' Laboratories, Inc., of Chicago, Illinois, issues its "Fire Protection Equipment List" in which are enumerated materials, assemblies, devices and appliances which have been tested to determine their fire hazard classification or their value with respect to fire resistance and fire protection, together with the conditions to be observed to secure the services for which they are designed. This list should be freely consulted.

In connection with the listings, systematic inspections are made of subsequent factory output to assure the maintenance of standards that have been set up. As evidence of such inspections and so that they may be recognized wherever found, devices of most of the more important classes are stamped or labeled, including the words "Underwriters' Laboratories, Inc., Inspected."

Among the more important classes of devices listed and having a relation to this code are concrete masonry units, floor and ceiling constructions, partitions, plaster aggregates, plaster bases, and column protections; fire doors and shutters; window frames and accessories, wired glass, and glass blocks; roof covering material; standpipes, sprinkler equipments, pumps, hose, extinguishers, and other appliances for fire protection. Anything included in this List should be acceptable as approved, within the meaning of that term as used in the National Building Code, to such extent and with such limitations as are indicated by the information, findings and classifications set forth in the above-mentioned List. Certain products appear therein in several graded classifications and in making selections from these products care should be taken to select products of the appropriate classification.

Fire Doors and Windows.

Wherever the code prescribes the use of an approved opening protective, only devices of a class that will fulfill the requirements of the particular service should be accepted. Doors, windows and shutters, are rated and classed according to the hazards involved to afford the necessary protection required under the conditions

of service. The protection of an opening depends not only upon the use of an approved door of the proper type, but also upon the use of approved hardware, frames, automatic closing mechanism, and accessories, as well as upon the installation of all parts in a standard manner. The Standards of the National Board of Fire Underwriters for the Protection of Openings in Walls and Partitions Against Fire, NBFU No. 80, give detailed requirements for their use and installation.

Doors for Class A situations are designed for the protection of openings in walls between separate buildings or sections of buildings. They should always be provided in fire walls (section 800).

Doors for Class B situations are designed for the protection of openings in enclosures to vertical communications through buildings. They are appropriate for openings in stairway enclosures (section 604.2e); for doors to horizontal exits (section 605.4); on all shafts (sections 804.3 and 1008.3c); for doors leading to boiler and furnace rooms (section 1101); in walls of refuse vaults; for doors leading to incinerator rooms; for service doors in incinerator chutes; in walls and partitions within stage enclosures (section 320.4a); and in walls or partitions separating garages from other occupancies (section 316.3a, 316.4b and 316.5b). Wired glass lights $\frac{1}{4}$ -inch thick are suitable for use in doors for Class B situations where the sum of the exposed area does not exceed 100 square inches and neither dimension exceeds 12 inches.

Doors for Class C situations are designed for the protection of openings in corridor and room partitions. They should not be used for Class B. situations. Wired glass, $\frac{1}{4}$ -inch thick is suitable for use in fire doors for openings in corridor and room partitions (Class C situations).

Doors, windows and shutters for Classes D, E and F situations are designed for the protection of openings in exterior walls.

Roof Covering Materials.

Class A includes roof coverings which are effective against severe fire exposures. Under such exposures roof coverings of this class are not readily flammable and do not carry or communicate fire, afford a fairly high degree of heat insulation to the roof deck; do not slip from position; possess no flying brand hazard; and do not require frequent repairs in order to maintain their fire-resisting properties.

Class B includes roof coverings which are effective against moderate fire exposures. Under such exposures roof coverings of this class are not readily flammable and do not readily carry or communicate fire; afford a moderate degree of heat insulation to the roof deck; do not slip from position; possess no flying brand hazard; but may require infrequent repairs in order to maintain their fire-resisting properties.

Class C includes roof coverings which are effective against light fire exposure. Under such exposures roof coverings of this

class are not readily flammable and do not readily carry or communicate fire; afford at least a slight degree of heat insulation to the roof deck; do not slip from position; possess no flying brand hazard; and may require occasional repairs or renewals in order to maintain their fire resisting properties.

Gas Appliances Approved For Use With Type B Gas Vents.

With respect to the approval of gas burning appliances under section 1009 of the National Building Code, it is suggested that the building official accept the published listings as shown in the "Gas and Oil Equipment List" of Underwriters' Laboratories, Inc. and the "Directory" of approved gas burning appliances of the American Gas Association Laboratories. Gas burning unit heaters and domestic type gas burning appliances, except incinerators and recessed heaters, which are so listed may be accepted as producing flue gas temperatures not in excess of 550 F. at the outlet of the draft hood. Recessed heaters are permitted to have flue gas temperatures of 550 F. at a point 3 feet 6 inches above the plane of the appliance flue outlet and therefore may produce flue gas temperatures in excess of 550 F. at the outlet of the draft hood. For listings of type B gas vents, see Underwriters' Laboratories, Inc. "Gas and Oil Equipment List" under the heading Flues.

In determining whether to permit the use of type B gas vents for venting boilers and furnaces having flue gas temperatures within the limit above specified, building officials should give consideration to the possibility of a change to solid or liquid fuel, and to the possibility of getting an approved chimney installed in case such a change is made. Where local conditions with respect to gas supply are such that change to other fuel is considered unlikely, or where arrangements can be made so that the building official will be notified of the change from gas to other fuel and so that the requirement for a chimney can then be enforced, it is suggested that the building official may safely permit the use of type B gas vents for venting heating boilers and furnaces having flue gas temperatures within the limit above specified.

APPENDIX D.

Exit Width Calculations.

The following example presents for the information of building inspectors and other public officials, architects, engineers and others interested in life safety in buildings an illustration for determining the minimum widths of the various components of exit ways as required in Article VI of the National Building Code.

Example

Assume a 3-story and basement building used for an educational occupancy. Assume that there is an auditorium (no base-

ment) in a wing 50 by 60 feet on the first floor; first floor area (including auditorium) 11,000 square feet, other floors 8,000 square feet per floor. Assume that there are no independent exit ways from basement or auditorium and that the occupants of the basement and auditorium must use first floor exit doors.

Number of occupants on upper floors and basement is 8,000 square feet divided by 40 square feet per person (the figure given in the table in section 601.2 for educational occupancies), or 200 occupants per floor. Therefore, in accordance with section 602.3 at least 2 separate exit ways shall be provided for each floor. They shall be so located that the maximum distance from any point in a floor area, room or space to an exit doorway, measured along the line of travel, is 100 feet. This distance may be measured from the corridor entrance of the classrooms. See section 603.

Number of units of stair width from upper stories will be:

$$\text{No. units stair width} = \frac{200}{60} = 3\frac{1}{3}$$

in which 200 = number of occupants

60 = number of occupants per story per unit of exit stairway width from section 604.5

Therefore 2, 2-unit stairways will be required. Stairways from basement will be the same. Note that the total number of stairways required is 2, not 2 for the third floor plus 2 for the second floor.

Number of units of door opening width for doorways opening onto the stairways will be:

$$\text{No. units door opening width} = \frac{200}{80} = 2\frac{1}{2}$$

in which 200 = number of occupants

80 = number of occupants per unit of door opening width from section 609.1

Therefore 2, 1½-unit door openings will be required. This should be accomplished by providing a door opening of at least 34 inches (36 in. nominal) at each stairway.

Units of door opening width required on street floor to comply with section 609 will be

- | | |
|--|-----|
| (a) To serve stairways from upper floors | |
| ¾ x 4 (section 609.1(c)(1)) | = 3 |
| (b) To serve stairways from basement | |
| ¾ x 4 (section 609.1(c)(1)) | = 3 |

(c) Number of occupants on street floor

$$\text{equals } \frac{8000}{40} + \frac{3000}{6} = 700$$

in which 8000 = area of educational occupancy

40 = area per occupant given in section 601.2

3000 = area of auditorium

6 = area per occupant given in section 601.2

Number of units of door opening width required to

$$\text{serve 700 occupants equals } \frac{700}{80} = 9$$

in which 80 = number of occupants per unit of door opening width from section 609.1.

Total units of door opening width required on street floor = 15

This requirement may be satisfied by providing 7, 44-inch door openings and one single unit door opening (minimum of 28 inches clear width) or other equivalent arrangement.

If the auditorium had independent exit ways, then the units of door opening width required on street floor to comply with section 609 will be

(a) To serve stairways from upper floors
 $\frac{3}{4} \times 4 = 3$

(b) To serve stairways from basement
 $\frac{3}{4} \times 4 = 3$

(c) To serve street floor (not counting auditorium)

$$\frac{8000}{40 \times 80} = 2.5$$

Total units of door opening width required on street floor = 8.5

Units of door opening width on street floor serving auditorium to comply with section 609 will be $\frac{50 \times 60}{6 \times 100} = 5$

in which 50 x 60 = area of auditorium

6 = area per occupant from section 601.2

100 = number of persons per unit of door opening width from section 609.1. Note that the figure

used is that given for a place of assembly (which an auditorium is by definition of a place of assembly.) This figure was not used in preceding computation because the assumption was that the exit ways from the auditorium were not independent.

APPENDIX E.

Flame Spread Ratings.

The following table presents for the information of building inspectors and other public officials, architects, engineers and others interested in fire safety in buildings the average flame spread ratings for various materials that may be used as interior finish. Modern codes and regulations set up maximum flame spread ratings for interior finish materials used in various occupancies. The data are presented in such form as to be useful in connection with such codes and regulations when the required test method for determining the flame spread ratings of interior finish materials under the codes or regulations is the same as that upon which the following information is based.

The ratings are derived in comparison with untreated red oak as 100 on the basis of tests conducted in accordance with the Standard Test Method for Fire Hazard Classification of Building Materials of Underwriters' Laboratories, Inc., ASTM E 84-50T, NFPA No. 255.

The ratings shown under Estimated Ratings are not intended to indicate the actual flame spread ratings of the materials but are given in such a manner that when used in connection with flame spread rating regulations, the materials may be classified for use. The ratings assigned structural fiber insulating board and plywood are based on tests of samples of current production. For structural fiber insulating board the rating obtained depends to a large extent upon the treatment given to the board and for plywood the rating depends largely upon the heat resisting characteristics of the adhesive used. Structural fiber insulating board improperly treated and plywood using adhesives having poor heat resisting qualities may have flame spread ratings in excess of those shown.

Provision regulating the flame spread rating of interior finish materials are found in section 808 of the National Building Code.

FLAME SPREAD RATINGS

Material	Average Flame Spread Rating
Materials listed in Underwriters' Laboratories, Inc. Fire Protection Equipment List under the following classification headings.	
Accoustical Materials	Rating as shown in listing
Asbestos-Cement Boards	
Batts and Blankets	
Building Units	
Coatings, Fire Retardant	
Coatings, Weather Protective	
Fiber, Sprayed	
Lumber, Treated by Impregnation	
Mineral Composition Units	
Plastic	
Plywood	
Protected Steel	
Sheathing	
Wall Coverings	
Estimated Ratings	
Ceramic Tile	Under 20
Concrete	Under 20
Glass	Under 20
Masonry	Under 20
Metal	Under 20
Plaster	Under 20
Stone	Under 20
Gypsum formboard, lath and wallboard	Under 20
Plywood conforming to U. S. Department of Commerce Commercial Standard CS45-55	Under 200
Structural fiber insulating board qualified as Class F under U. S. Department of Commerce Commercial Standard CS42-49	Under 200
Untreated wood one inch thick, nominal dimension	Under 200

APPENDIX F.

Sheathing.

The following table presents for the information of building inspectors and other public officials, architects, engineers and others interested in structural safety in buildings the various types of sheathing materials which, when properly nailed, may be

APPENDIX G

accepted as providing the necessary rigidity for wood frame walls as required in section 708.5(a) of the National Building Code.

Material	Nominal Thickness (Inches)
Fiber insulating board qualified as Class E under U. S. Department of Commerce Commercial Standard CS 42-49	1/2
Gypsum sheathing complying with ASTM C 79-54	1/2
Plywood sheathing conforming to U. S. Depart- ment of Commerce Commercial Standard CS 45-55	5/16

APPENDIX G.

Design Dead Loads.

In the design of buildings and structures it is recommended that the following weights of building materials and assemblies be used in determining the dead loads. The information contained in the following list is in accordance with information contained in the appendix of the American Standard Building Code Requirements for Minimum Design Loads in Buildings and Other Structures, ASA A58.1-1955. Information supplementary to the following may be found in the American Standard.

WALLS	lb. per sq. ft.
4-inch clay brick, high absorption	34
4-inch clay brick, medium absorption	39
4-inch clay brick, low absorption	46
4-inch sand-lime brick	38
4-inch concrete brick, heavy aggregate	46
4-inch concrete brick, light aggregate	33
8-inch clay brick, high absorption	69
8-inch clay brick, medium absorption	79
8-inch clay brick, low absorption	89
8-inch sand-lime brick	74
8-inch concrete brick, heavy aggregate	89
8-inch concrete brick, light aggregate	68
12½-inch clay brick, high absorption	100
12½-inch clay brick, medium absorption	115
12½-inch clay brick, low absorption	130
12½-inch sand-lime brick	105
12½-inch concrete brick, heavy aggregate	130
12½-inch concrete brick, light aggregate	98
17-inch clay brick, high absorption	134
17-inch clay brick, medium absorption	155
17-inch clay brick, low absorption	173
17-inch sand-lime brick	138
17-inch concrete brick, heavy aggregate	174
17-inch concrete brick, light aggregate	130
22-inch clay brick, high absorption	168
22-inch clay brick, medium absorption	194
22-inch clay brick, low absorption	216
22-inch sand-lime brick	173
22-inch concrete brick, heavy aggregate	216
22-inch concrete brick, light aggregate	160
4-inch brick, 4-inch load-bearing structural clay tile backing	60
4-inch brick, 8-inch load-bearing structural clay tile backing	75

DESIGN DEAD LOADS

WALLS—Continued

	lb. per sq. ft.
8-inch brick, 4-inch load-bearing structural clay tile backing	102
8-inch load-bearing structural clay tile	42
12-inch load-bearing structural clay tile	58
8-inch concrete block, heavy aggregate	55
12-inch concrete block, heavy aggregate	85
8-inch concrete block, light aggregate	35
12-inch concrete block, light aggregate	55
2-inch furring tile, one side of masonry wall, add to above figures	12

PARTITIONS

3-inch clay tile	17
4-inch clay tile	18
6-inch clay tile	28
8-inch clay tile	34
10-inch clay tile	40
2-inch facing tile	15
4-inch facing tile	25
6-inch facing tile	38
2-inch gypsum block	9½
3-inch gypsum block	10½
4-inch gypsum block	12½
5-inch gypsum block	14
6-inch gypsum block	18½
2-inch solid plaster	20
4-inch solid plaster	32
4-inch hollow plaster	22
4-inch concrete block, heavy aggregate	30
6-inch concrete block, heavy aggregate	42
8-inch concrete block, heavy aggregate	55
12-inch concrete block, heavy aggregate	85
4-inch concrete block, light aggregate	20
6-inch concrete block, light aggregate	28
8-inch concrete block, light aggregate	38
12-inch concrete block, light aggregate	55
Wood studs 2 x 4, unplastered	4
Wood studs 2 x 4, plastered one side	12
Wood studs 2 x 4, plastered two sides	20

GLASS-BLOCK MASONRY

4-inch glass-block walls and partitions	18
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SPLIT FURRING TILE

1½-inch	8
2-inch	8½

CONCRETE SLABS

Concrete, reinforced, stone, per inch	12½
Concrete, reinforced, cinder, per inch	9½
Concrete, reinforced, lightweight, per inch	9
Concrete, plain, stone, per inch	12
Concrete, plain, cinder, per inch	9
Concrete, plain, lightweight, per inch	8½

APPENDIX G

RIBBED SLABS

Depth, in inches	Width of rib, in inches				
	4	5	6	7	8
	lb. per sq. ft.	lb. per sq. ft.	lb. per sq. ft.	lb. per sq. ft.	lb. per sq. ft.
12-inch clay-tile fillers:					
4 plus 2	49	51	52	54	—
6 plus 2	60	63	65	67	—
8 plus 2½	79	82	85	87	—
10 plus 3	96	100	103	106	—
12 plus 3	108	112	116	120	—
					Add for tapered ends
					lb. per sq. ft.
20-inch metal fillers					
6 plus 2	41	43	45	47	— 4
8 plus 2½	51	54	57	60	— 5
10 plus 3	63	67	70	74	— 5
12 plus 3	69	74	78	82	86 5
14 plus 3	75	81	82	87	91 5
30-inch metal fillers:					
6 plus 2½	41	43	45	47	— 3
8 plus 2½	45	48	50	54	— 4
10 plus 3	56	59	61	65	— 4
12 plus 3	—	63	67	70	73 4
14 plus 3	—	69	72	76	80 4
2-way clay-tile fillers (12 x 12):					
4 plus 2	61	62	64	—	—
6 plus 2	87	89	90	—	—
8 plus 2½	100	103	107	—	—
10 plus 3	121	126	131	—	—
12 plus 3	136	141	146	—	—
2-way metal fillers (16 x 16):					
4 plus 2	44	47	50	—	—
6 plus 2	55	60	63	—	—
8 plus 2½	72	78	83	—	—
10 plus 3	91	96	103	—	—
12 plus 3	103	111	118	—	—
14 plus 3	116	125	133	—	—
2-way metal fillers (20 x 20):					
4 plus 2	42	44	46	—	—
6 plus 2	50	54	58	—	—
8 plus 2½	66	71	76	—	—
10 plus 3	83	88	94	—	—
12 plus 3	93	100	107	—	—
14 plus 3	105	113	120	—	—

DESIGN DEAD LOADS

FLOOR FINISH AND FILL

	Finish floor to top slab inches	Load lb. per sq. ft.
Double $\frac{7}{8}$ " wood on sleepers, light-concrete fill	4	19
Do	5	26
Double $\frac{7}{8}$ " wood on sleepers, stone-concrete fill	4	28
Do	5	40
Single $\frac{7}{8}$ " wood on sleepers, light-concrete fill	4	23
Do	5	30
Single $\frac{7}{8}$ " wood on sleepers, stone-concrete fill	4	40
Do	5	50
3-inch wood block on mastic, no fill	3	10
$\frac{7}{8}$ -inch wood block on stone-concrete fill	4	40
1-inch cement finish on stone-concrete fill	4	48
1-inch terrazzo on stone-concrete fill	4	48
Clay tile on stone-concrete fill	4	48
Marble and mortar on stone-concrete fill	4	50
Linoleum on stone-concrete fill	4	46
Do	5	58
Linoleum on light-concrete fill	4	27
Do	5	34

FLOOR FINISH

	Thickness inches	Load lb. per sq. ft.
1½-inch asphalt mastic flooring	1½	18
3-inch wood block on ½-inch mortar base	3½	16
Solid flat tile on 1-inch mortar base	2	23
2-inch asphalt block, ½-inch mortar	2½	30
1-inch terrazzo, 2-inch stone concrete	3	38

WATERPROOFING

Five-ply membrane	½	5
Five-ply membrane, mortar, stone concrete	5	55
2-inch split tile, 3-inch stone concrete	5	45

FLOOR FILL

Cinder concrete, per inch	—	9
Lightweight concrete, per inch	—	7
Sand, per inch	—	8
Stone concrete, per inch	—	12

WOOD-JOIST FLOORS (NO PLASTER) DOUBLE WOOD FLOOR

Joist sizes, in inches:	12-inch spacing lb. per sq. ft.	16-inch spacing lb. per sq. ft.
2 x 6	6	5
2 x 8	6	6
2 x 10	7	6
2 x 12	8	7
3 x 6	7	6
3 x 8	8	7
3 x 10	9	8
3 x 12	11	9
3 x 14	12	10

APPENDIX G

CEILINGS

	lb. per sq. ft.
Plaster on tile or concrete	5
Suspended metal lath and gypsum plaster	10
Suspended metal lath and cement plaster	15
Plaster on wood lath	8

ROOF AND WALL COVERINGS

Asphalt shingles	2
Cement asbestos shingles	4
Cement tile	16
Clay tile (for mortar add 10 lbs.):	
2-inch book tile	12
3-inch book tile	20
Roman	12
Spanish	19
Ludowici	10
Composition:	
Three-ply ready roofing	1
Four-ply felt and gravel	5½
Five-ply felt and gravel	6
Copper or tin	1
Corrugated asbestos-cement roofing	4
Corrugated iron	2
Fiberboard, ½-inch	¾
Gypsum sheathing, ½-inch	2
Skylight, metal frame, ⅜-inch wire glass	8
Slate, 3/16-inch	7
Slate, ¼-inch	10
Wood sheathing, per inch thickness	3
Wood shingles	3

MATERIALS

	lb. per cu. ft.
Cast-stone masonry (cement, stone, sand)	144
Cinder fill	57
Concrete, plain:	
Cinder	108
Expanded-slag aggregate	100
Haydite (burned-clay aggregate)	90
Slag	132
Stone (including gravel)	144
Vermiculite and perlite aggregate, non-load-bearing	25-50
Other light aggregate, load-bearing	70-105
Concrete, reinforced:	
Cinder	111
Slag	138
Stone (including gravel)	150
Masonry, ashlar:	
Granite	165
Limestone, crystalline	165
Limestone, oolitic	135
Marble	173
Sandstone	144
Masonry, brick:	
Hard (low absorption)	130
Medium (medium absorption)	115
Soft (high absorption)	100

DESIGN DEAD LOADS

	lb. per cu. ft.
Masonry, rubble mortar:	
Granite	153
Limestone, crystalline	147
Limestone, oolitic	138
Marble	156
Sandstone	137
Terra cotta, architectural:	
Voids filled	120
Voids unfilled	72
Timber, seasoned:	
Ash, commercial white	41
Cypress, southern	32
Fir, Douglas, coast region	34
Oak, commercial reds and whites	45
Pine, southern yellow	39
Redwood	28
Spruce, red, white, and Sitka	28

Note: Weights of masonry include mortar but not plaster. For plaster, add 5 lb/ft² for each face plastered. Values given represent averages. In some cases there is a considerable range of weight for the same construction.

APPENDIX H.

Roof Loads.

The design live load for roofs given in section 902.5 of the National Building Code is the minimum that should be used regardless of the location of the municipality. The figure given in the code is suitable for use in areas subject to light snowfall. However, in areas subject to frequent or heavy snowfalls the minimum design load for roofs should be increased commensurate with the amount of snowfall that may be expected in the area. Further information on design live loads for roofs may be found in the American Standard Building Code Requirements for Minimum Design Loads in Buildings and Other Structures, ASA A58.1-1955.

APPENDIX I

Heat Producing Appliances, Heating, Ventilating, Air Conditioning, Blower and Exhaust Systems.

The following code has been drafted in form to be cited in a building code as the code, compliance with which will be deemed to satisfy a code provision that the equipment mentioned shall be installed in accordance with standard practice for safe installation and use. The National Building Code contains such a provision in section 1100.

This code is also suitable for adoption by a building official under power granted him to adopt rules or regulations for carrying into effect the basic provisions of a code; also for adoption as code text where it is desired to present the full details in the code.

Data which will be helpful in applying certain provisions of this code, including information on listed appliances, are given under the heading Supplementary Information, following section 18 of this code.

CODE

For the Installation of HEAT PRODUCING APPLIANCES, Heating, Ventilating, Air Conditioning, Blower and Exhaust Systems.

CONTENTS

- Section 1. General Requirements and Definitions.
2. Heating Furnaces and Boilers.
3. Heating and Cooking Appliances.
4. Floor Furnaces.
5. Unit Heaters.
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7. Restaurant Type Cooking Appliances.
8. Industrial Furnaces and Power Boilers, Stationary Type
9. Appliance Connections to Chimneys or Vents.
10. Ventilating Hoods.
11. Steam and Hot Water Pipes.
12. Residence Type Warm Air Heating and Air Conditioning Systems.
13. Air Conditioning, Warm Air Heating, Air Cooling and Ventilating Systems of other Than Residence Type.
14. Domestic Type Incinerators.
15. Flue-fed Incinerators (Apartment House Type).
16. Commercial and Industrial Type Incinerators.
17. Blower and Exhaust Systems for Dust, Stock and Vapors.
18. Heating and Ventilating Equipment in Hazardous Occupancies.
- Supplementary Information—Listed Appliances—High Pressure Steam and Hot Oil Pipes.

SECTION 1. GENERAL REQUIREMENTS AND DEFINITIONS.

1.1. Accessibility.

The installation of heat producing appliances shall in all cases be such as to make them accessible for cleaning, operation and maintenance.

1.2. Air for combustion.

Suitable provision shall be made where necessary for intake of air needed for combustion of fuel burning appliances.

1.3. Definitions.

Attic furnace. See section 2.1.

Central furnace. See section 2.1.

Central warm air heating system. See section 12.2.

Combustible material as pertaining to materials adjacent to or in contact with heat producing appliances, flue pipes and vent connectors, steam and hot water pipes, and warm air ducts means material made of or surfaced with wood, compressed paper, plant fibers or other material that will ignite and burn. Such material shall be considered as combustible even though flameproofed, fire retardant treated, or plastered. Gypsum or other wallboards that are surfaced with combustible material are classified as combustible.

Downflow furnace. See section 2.1.

Duct furnace. See section 2.1.

Forced air system. See section 12.2.

Forced warm air furnace. See section 2.1.

Floor furnace. See section 4.1.

Floor mounted heating and cooking appliances. See section 3.1.

Flue pipe means a pipe or breeching connecting a solid or liquid fuel burning appliance to a chimney.

Gravity furnace. See section 2.1.

Gravity system. See section 12.2.

Heat exchanger. See section 12.2.

Heating furnaces and boilers. See section 2.1.

High heat appliance. See section 8.1.

Low heat appliance. See section 8.1.

Medium heat appliance. See section 8.1.

Plenum. See section 12.2.

Recessed heater. See section 6.1.

Restaurant type cooking appliances. See section 7.1.

Return System. See section 12.2.

Room heater. See section 3.1.

Supply system. See section 12.2.

Unit heater. See section 5.1.

Vent connector means a pipe connecting a gas burning appliance to a gas vent or to a chimney.

Wall heater. See section 6.1.

SECTION 2. HEATING FURNACES AND BOILERS.

2.1. Definitions.

(a) **Heating furnaces and boilers** shall include central furnaces, hot water boilers operating at not in excess of 250 F., steam boilers operating at not in excess of 15 pounds gauge pressure and floor mounted unit heaters, used for heating of buildings or structures.

(b) **Central furnace** means a self-contained, flue connected or vented appliance intended primarily to supply heated air through ducts to spaces remote from or adjacent to the appliance location as well as to the space in which it is located.

(c) **Forced warm air furnace** means a furnace equipped with a blower which provides the primary means for circulation of air;

attic furnace means a forced warm air furnace designed specifically for installation in an attic or in a space with low headroom, normally unoccupied;

downflow furnace means a forced warm air furnace designed with air flow through the furnace essentially in a vertical path, discharging air at or near the bottom of the furnace;

duct furnace means a furnace designed for insertion or installation in a duct of an air distribution system to supply warm air for heating and which depends for air circulation on a blower not furnished as a part of the furnace.

(d) **Gravity furnace** means a central furnace depending primarily on circulation of air by gravity.

(e) **Unit heater**—See section 5.1.

(f) Devices referred to as “such that flame or hot gases do not come in contact with the base” include conventional type heating furnaces and boilers having an ash pit or similar space beneath the burning fuel (whether gas, liquid or solid) and like devices in which the base is not directly exposed to the flame or the products of combustion.

2.2. Mounting.

(a) Furnaces and boilers, except as provided in paragraphs (b), (c), (d), (e), (f) and (g) of this section 2.2, shall be mounted on the ground, or on floors of fire-resistive construction with non-combustible flooring and surface finish and with no combustible material against the underside thereof, or on fire-resistive slabs or arches having no combustible material against the underside thereof. Such construction shall extend not less than 12 inches beyond the appliance on all sides, and where solid fuel is used, it

shall extend not less than 18 inches at the front or side where ashes are removed.

(b) Furnaces and boilers that are approved specifically for installation on a floor constructed of combustible material may be mounted in accordance with the conditions of such approval.

(c) Forced warm air furnaces may be mounted on floors other than as specified in paragraph 2.2(a), provided they are so arranged that the fan chamber occupies the entire area beneath the firing chamber and forms a well ventilated air space between the firing chamber and the floor of not less than 18 inches in height with at least one metal baffle between the firing chamber and the floor.

(d) Heating boilers of the water-base type may be mounted on floors other than as specified in paragraph 2.2(a), provided the water chamber extends under the whole of the ash pit and the fire-box, or under the whole of the firing chamber if there is no ash pit. If solid fuel is used see paragraph 2.2(h).

(e) Heating furnaces and boilers which are set on legs that provide not less than 4 inches open space under the base of the appliance may be mounted on floors other than as specified in paragraph 2.2(a), provided the appliance is such that flame or hot gases do not come in contact with its base, and further provided the floor under the appliance is protected with asbestos millboard not less than $\frac{1}{4}$ of an inch thick covered with sheet metal of not less than 24 gauge. The above specified floor protection shall extend not less than 6 inches beyond the appliance on all sides, except that where the appliance is approved in accordance with paragraph 2.3(b) for a clearance of less than 6 inches to a combustible wall, the specified floor protection shall extend either to the wall or out for a distance of 6 inches whichever is the lesser distance. If solid fuel is used see paragraph 2.2(h).

(f) Heating furnaces and boilers may be mounted on floors other than as specified in paragraph 2.2(a), provided the appliance is such that flame or hot gases do not come in contact with its base, and further provided the floor under the appliance is protected with hollow masonry not less than 4 inches thick covered with sheet metal of not less than 24 gauge. Such masonry shall be laid with ends unsealed and joints matched in such a way as to provide a free circulation of air from side to side through the masonry. If solid fuel is used see paragraph 2.2(h).

(g) Heating furnaces and boilers which are arranged so that flame or hot gases come in contact with the base may be mounted on floors other than as specified in paragraph 2.2(a), provided the floor under the appliance is protected by two courses of 4-inch hollow masonry, with courses laid at right angles and with ends unsealed and joints matched in such a way as to provide a free circulation of air through each masonry course. Such masonry shall be covered with a steel plate not less than $\frac{3}{16}$ of an inch thick. If solid fuel is used see paragraph 2.2(h).

Table 2.3(a).

Clearances to Combustible Material for Furnaces, Boilers and Heat Exchangers Installed in Rooms Which Are Large in Comparison With Size of Appliance Except as Provided in Paragraph 2.3(a)(1).

	Minimum Clearance, Inches				
	Above and Sides of Bonnet or Plenum	Jacket Sides and Rear	Front See Note 1	Projecting Flue Box or Draft Hood	Flue Pipe or Vent Connector
I. Automatically fired, forced air or gravity furnace, equipped with 250°F temperature limit control installed in accordance with Note 2.					
Burning liquid fuel	16	6	24	18 ⁵	18 ⁵
Burning gas fuel	16	6	18	9 ⁴	9 ⁴
Utilizing electricity	16	6	18	—	—
II. Automatically fired, forced air or gravity furnace, equipped with limit control not conforming to Note 2, but has been tested by an approved agency and found to have outlet air temperature not exceeding 250°F.					
Burning liquid fuel	2	6	24	18 ⁵	18 ⁵
Burning gas fuel	2	6	18	6	6
Utilizing electricity	2	6	18	—	—
III. Steam or Hot Water Heat Exchanger—Steam not over 15 pounds gauge pressure and hot water not more than 250°F.	1	1	1	—	—
IV. Automatically stoker fired, forced air system equipped with 250°F temperature limit control installed in accordance with Note 2 and barometric draft control. See Note 3.					
Burning solid fuel		6	48	18	18
V. Heating Boilers—Steam boilers operating at not over 15 pounds gauge pressure and hot water boilers operating at not in excess of 250°F of the water-wall type or having a jacket or lining of masonry or other satisfactory material.					
Burning liquid fuel	6	6	24	18 ⁵	18 ⁵
Burning gas fuel	6	6	18	9 ⁴	9 ⁴
Burning solid fuel	6	6	48	18	18
VI. Furnaces and Boilers, other than above.					
Burning liquid fuel	18	18	48	18	18
Burning gas fuel	18	18	18	9 ⁴	9 ⁴
Burning solid fuel	18	18	48	18	18

Notes:

1. Front clearance shall be sufficient for servicing the burner and furnace.
2. Limit control that has been tested by an approved agency and that cannot be set higher than 250 F. installed not more than 10 inches above the top surface of the heat exchanger in a supply plenum that extends at least 12 inches above the top surface of the heat exchanger.
3. Barometric draft control operated by draft intensity and permanently set to limit the draft to a maximum intensity of 0.13 inches of water gauge.
4. This clearance may be reduced to 6 inches for gas burning furnaces and boilers that have been tested by an approved agency and found to have flue gas temperatures not exceeding 550 F. This clearance does not apply to approved Type B gas vents used and installed in accordance with the conditions of such approval.
5. For liquid fuel burning furnaces and boilers that are approved specifically for installation with lesser clearances flue pipes may be installed in accordance with the conditions of such approval.
6. If limit control cannot be set higher than 250 F. but note 2 is not otherwise complied with, this clearance shall be 6 inches.

(h) In all cases where heating furnaces and boilers burning solid fuel are mounted on floors other than as specified in paragraph 2.2(a), the floor for not less than 18 inches beyond the front of the appliance or side where ashes are removed shall be protected with asbestos millboard not less than $\frac{1}{4}$ of an inch thick covered with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

2.3. Clearances.

(a) Heating furnaces and boilers installed in rooms which are large in comparison with the size of the appliance, except as provided in paragraphs (1), (2), and (3) below, shall be installed to provide clearances to woodwork or other combustible material not less than as shown in Table 2.3(a). Floor mounted unit heaters shall be installed with clearances as required in Table 2.3(a) for appliances of similar heat producing characteristics and with similar controls.

(1) Heating furnaces and boilers that have been tested by an approved testing agency and found to require clearances greater than specified in Table 2.3(a) shall be installed with such clearances unless protected as specified in paragraph (3) of this section 2.3(a).

(2) Heating furnaces and boilers that are approved specifically for installation with clearances less than specified in Table 2.3(a) may be installed in accordance with the conditions of such approval.

(3) Heating furnaces and boilers may be installed in rooms, but not in confined spaces such as alcoves or closets, with reduced clearances to woodwork or other combustible material provided the combustible material or the appliance is protected as described in Table 2.3(b).

(b) Heating furnaces and boilers shall not be installed in confined spaces such as alcoves or closets unless they have been approved specifically for such installation and are installed in accordance with the conditions of such approval. Installation

Table 2.3(b).
Clearances, Inches, With Specified Forms of Protection.*

Type of Protection. Applied to the combustible material un- less otherwise specified and covering all surfaces within the distance specified as the required clearance with no protec- tion. (See Fig. 2.3). Thicknesses are minimum.	Where the required Clearance with no protection is:										
	36 inches		18 inches		12 inches		9 inches		6 inches		
	Above & Rear	Sides & Flue Pipe	Above & Rear	Sides & Flue Pipe or Vent Con- nector	Above & Rear	Sides & Flue Pipe or Vent Con- nector	Above & Rear	Sides & Flue Pipe or Vent Con- nector	Above & Rear	Sides & Flue Pipe or Vent Con- nector	
(a) ¼ in. asbestos millboard spaced out 1 in.†	30	18	30	15	9	12	9	6	3	2	3
(b) 28 gauge sheet metal on ¼ in. asbestos millboard	24	18	24	12	9	12	9	6	4	3	2
(c) 28 gauge sheet metal spaced out 1 in.†	18	12	18	9	6	9	6	4	4	2	2
(d) 28 gauge sheet metal on ⅛ in. asbestos millboard spaced out 1 in.†	18	12	18	9	6	9	6	4	4	2	2
(e) ½ in. asbestos cement covering on heating appliance	18	12	36	9	6	18	6	4	9	2	1
(f) ¼ in. asbestos millboard on 1 in. rockwool bats reinforced with wire mesh or equivalent	18	12	18	6	6	6	4	4	4	2	2
(g) 22 gauge sheet metal on 1 in. rockwool bats reinforced with wire or equivalent	18	12	12	4	3	3	2	2	2	2	2
(h) ¼ in. asbestos cement board or ¼ in. asbestos millboard	36	36	36	18	18	18	12	12	9	4	4
(i) ¼ in. cellular asbestos	36	36	36	18	18	18	12	12	9	3	3

* Except for the protection described in (e), all clearances shall be measured from the outer surface of the appliance to the combustible material disregarding any intervening protection applied to the combustible material but in no case shall the clearance be such as to interfere with the requirements for combustion air and for accessibility.

For the protection described in (e), the clearance shall be measured from the outer surface of the protective covering to the combustible material.

† Spacers shall be of noncombustible material.

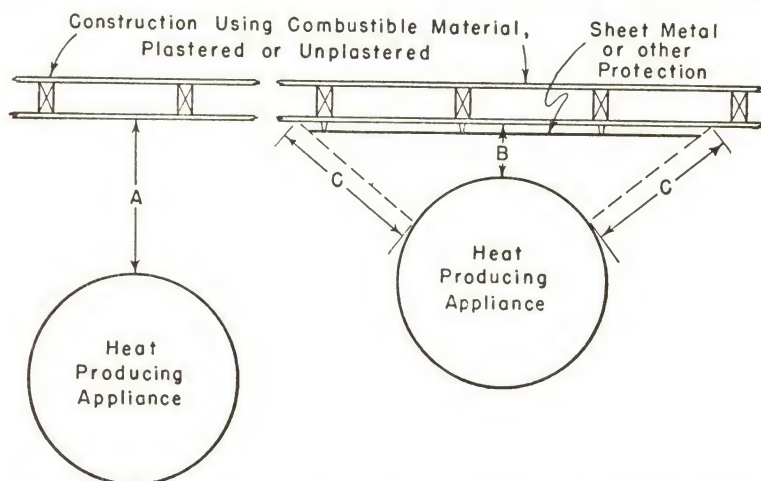


Figure 2.3. Extent of protection required to reduce clearances from heating appliances, flue pipes or vent connectors.

A equals the required clearance with no protection, specified in Tables 2.3(a) and 3.3 and in the sections applying to the various types of appliances.

B equals the reduced clearance permitted in accordance with Table 2.3(b). The protection applied to the construction using combustible material shall extend far enough in each direction to make *C* equal to *A*.

clearances for furnaces and boilers in confined spaces shall not be reduced by protection methods described in Table 2.3(b).

(c) Where the plenum is adjacent to plaster on metal lath or other noncombustible material attached to combustible material, the clearance shall be measured to the surface of the plaster or other noncombustible finish where the clearance specified is 2 inches or less.

2.4. Controls.

(a) Temperature limit controls. Temperature limit controls shall be of an approved type and shall be such that they cannot be set higher than the specified temperature setting.

(b) Fan control for stoker-fired furnaces. When a warm air furnace that is equipped with a fan to circulate the air is stoker-fired, the furnace shall also be equipped with an automatic over-run control to start the fan when the air in the furnace bonnet or at the beginning of the main supply duct at a point not affected by radiated heat reaches a temperature not higher than 200 F. after the stoker and fan (in its normal operation) have been shut down as a result of a satisfied thermostat. If a manual disconnect is installed in the air circulating fan electrical circuit, it shall be so installed as to de-energize simultaneously both the fan and the stoker.

2.5. Attic furnaces.

(a) Heating furnaces shall not be installed in attics unless they are of a type that has been approved specifically for such installation.

(b) Attic furnaces shall be installed in accordance with the mounting and clearance provisions of sections 2.2 and 2.3.

2.6. Downflow furnaces.

(a) Requirements. Downflow furnaces shall be automatically operated gas or liquid fuel burning or electric furnaces that are equipped with approved temperature limit controls that will limit outlet air temperature to 200 F. Downflow furnaces shall be designed to prevent unsafe temperatures in the event of reverse flow.

(b) Mounting.

(1) Downflow furnaces shall not be mounted on floors other than specified in paragraph 2.2(a), unless the appliance rests upon hollow masonry not less than 4 inches thick. Such masonry units shall be laid with ends unsealed and joints matched in such a manner as to allow circulation of air through the masonry. See figure 2.6.

(2) Downflow furnaces that are approved specifically for installation on a floor constructed of combustible material may be mounted in accordance with the conditions of such approval.

(3) Downflow furnaces shall be installed so that there are no open passages in the floor through which flame or hot gases from a fire originating in the space below the floor can travel to the room above.

(c) Clearances. Downflow furnaces shall be installed in accordance with clearance provisions of section 2.3.

2.7. Duct furnaces.

(a) Support. Duct furnaces shall be firmly supported.

(b) Clearances. Duct furnaces, except as provided in paragraphs (c) and (e) of this section 2.7, shall be installed with clearances of at least 6 inches to adjacent walls, ceilings and floors constructed of combustible material.

(c) Duct furnaces that are approved specifically for installation with lesser clearances than specified in paragraph 2.7(b) may be installed in accordance with the conditions of such approval.

(d) Duct furnace flue pipes, except as provided in paragraph 2.7(e), shall be installed to provide clearances to woodwork or other combustible material not less than 18 inches. Vent connectors for such appliances, except as provided in paragraphs (e) and (f) of this section 2.7, shall be installed to provide clearances to combustible material not less than 9 inches.

(e) Duct furnaces and their flue pipes or vent connectors may be installed in rooms, but not in confined spaces such as alcoves or closets, with reduced clearances to woodwork or other combustible material, provided the combustible material is protected as described in Table 2.3(b).

(f) Gas burning duct furnaces that have been tested by an approved agency and found to have flue gas temperatures not

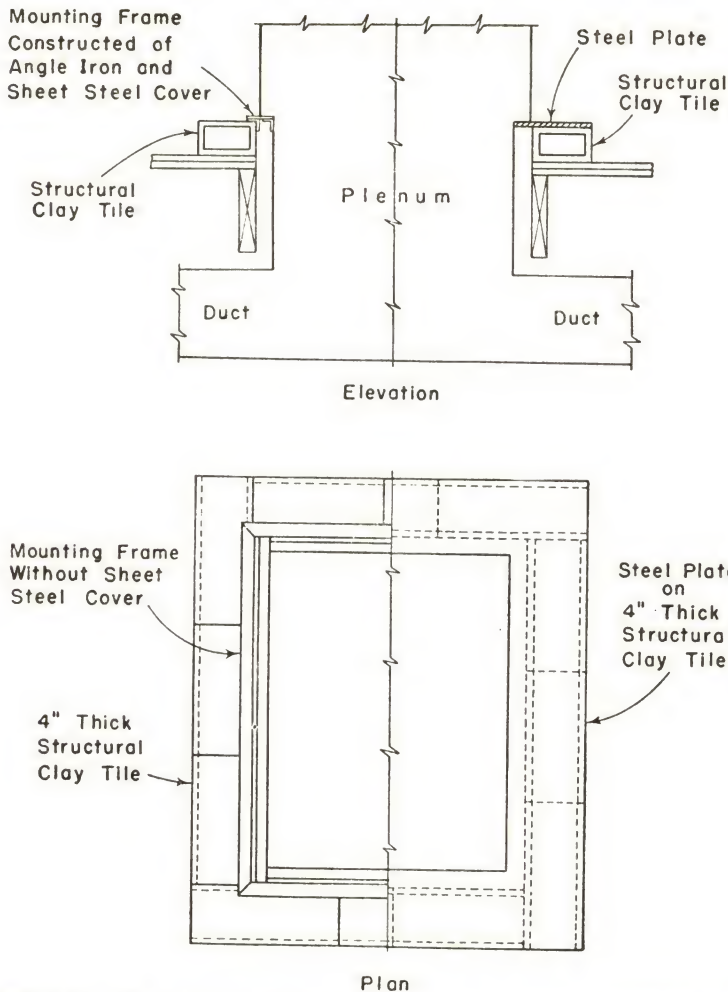


Figure 2.6. Two typical methods of mounting a downflow furnace on a floor constructed of combustible material.

exceeding 550 F. may be installed with clearance to woodwork or other combustible material from metal flue or vent connectors of 6 inches, and from approved type B gas vents the clearance may be reduced in accordance with the conditions of such approval.

(g) Access panels. The ducts connected to or enclosing duct furnaces shall have removable access panels on both the upstream and the downstream sides of the furnace.

(h) Controls. Controls shall be located outside the duct except for the sensing element of a control.

2.8. Hand-fired solid fuel burning furnaces.

(a) Thermostatically controlled furnaces. Hand-fired solid fuel burning furnaces in which the furnace draft is controlled by

a thermostat shall be equipped with (1) a fail safe 250 F. limit control that is installed not more than 10 inches above the top surface of the heat exchanger in a supply plenum that extends at least 12 inches above the top surface of the heat exchanger, and (2) a barometric draft control that is operated by draft intensity and is permanently set to limit the draft to a maximum intensity of 0.13 inches of water gauge. By a fail safe limit control is meant one that will automatically check the furnace in the event of power failure or shut off, or that will automatically check the furnace when 250 F. temperature is reached whether or not power is then available.

(b) Air circulating fan controls. When a hand-fired solid fuel burning furnace is equipped with a fan to circulate the air, the furnace shall be equipped with fan controls as required for stoker fired furnaces by paragraph 2.4(b).

SECTION 3. HEATING AND COOKING APPLIANCES.

3.1. Definitions.

(a) Floor mounted heating and cooking appliances shall include domestic type cooking stoves and ranges, laundry stoves, room heaters (heating stoves), gas-steam or gas-hot water radiators, and water heaters, of types designed for mounting on the floor, and such other appliances as may be so classified by the building official.

(b) Room heaters mean above-the-floor devices for direct heating of the space in and adjacent to that in which the device is located, without external heating pipes or ducts.

(c) Restaurant type cooking appliances. See section 7.1.

3.2. Mounting.

(a) Floor mounted heating and cooking appliances, except as provided in paragraphs (b), (c), (d) and (e) of this section 3.2, shall be mounted on the ground or on floors of fire-resistive construction with noncombustible flooring and surface finish, or on fire-resistive slabs or arches having no combustible material against the underside thereof. Such construction shall in all cases extend not less than 6 inches beyond the appliance on all sides, and where solid fuel is used shall extend not less than 18 inches at the front or side where ashes are removed.

(b) Floor mounted heating and cooking appliances that are approved specifically for installation on a floor constructed of combustible material may be mounted in accordance with the conditions of such approval.

(c) Floor mounted heating and cooking appliances which are set on legs or simulated legs that provide not less than 4 inches open space under the base of the appliance may be mounted on floors other than as specified in paragraph 3.2(a), provided the floor under the appliance is protected with sheet metal of not less than 24 gauge, or by other approved noncombustible material. Where solid fuel is used, the protection shall extend not less than 18 inches beyond the appliance at the front or side where ashes

are removed. With radiating type gas burning room heaters which make use of metal, asbestos or ceramic material to direct radiation to the front of the device, the floor protection shall extend out at the front not less than 36 inches when the heater is not of a type approved for installation on a combustible floor.

(d) Floor mounted heating and cooking appliances which are set on legs that provide not less than 18 inches open space under the base of the appliance, or which have no burners and no portion of any oven or broiler within 18 inches of the floor, may be mounted on floors other than as specified in paragraph 3.2(a) without special floor protection, provided there is at least one sheet metal baffle between the burners and the floor.

(e) Floor mounted heating and cooking appliances may be mounted on floors other than as specified in paragraph 3.2(a), provided the floor under the appliance is protected with hollow masonry not less than 4 inches thick covered with sheet metal of not less than 24 gauge. Such masonry shall be laid with ends unsealed and joints matched in such a way as to provide a free circulation of air from side to side through the masonry. Where solid fuel is used, the floor for 18 inches beyond the front of the appliance or side where ashes are removed shall be protected with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

3.3. Clearances.

(a) Floor mounted heating and cooking appliances, except as provided in paragraphs 3.3(b) and (c), shall be installed to provide clearances to woodwork or other combustible material not less than as shown in Table 3.3.

(b) Floor mounted heating and cooking appliances that are approved specifically for installation with lesser clearances than specified in paragraph 3.3(a) may be installed in accordance with the conditions of such approval.

(c) Floor mounted heating and cooking appliances may be installed in rooms, but not in confined spaces such as alcoves or closets, with reduced clearances to woodwork or other combustible material, provided the combustible material or the appliance is protected as described in Table 2.3(b).

(d) Cooking stoves and ranges and room heaters shall have a clearance vertically above the top of not less than 36 inches to woodwork or other combustible material, provided that when the underside of such combustible material is protected with asbestos millboard at least $\frac{1}{4}$ of an inch thick covered with sheet metal of not less than 28 gauge, the distance shall be not less than 2 feet. The protection shall extend 9 inches beyond the sides of the appliance.

(e) Liquid fuel burning, floor mounted heating and cooking appliances which have a fuel tank attached thereto shall in all cases be installed with sufficient clearance to provide direct and easy access to the fuel tank.

Table 3.3.
Clearances to Combustible Material.

Floor Mounted Heating and Cooking Appliances	Minimum Clearance—Inches Sides and Rear	Flue Pipe or Vent Connector
Domestic type ranges and cooking stoves.		
Burning solid fuel in firepot without fire clay lining	36 ¹	18
Burning solid fuel in firepot with fire clay lining	24 ¹	18
Burning liquid fuel	24 ¹	18 ²
Burning gas fuel	6	6 ³
Room heaters (heating stoves) circulating type. ⁵		
Burning solid fuel	12	18
Burning liquid fuel	12	18 ²
Burning gas fuel	12	9 ⁴
Room heaters (heating stoves), heat radiating or other than circulating type.		
Burning solid fuel	36	18
Burning liquid fuel	36	18 ²
Burning gas fuel	18 ⁶	9 ⁴
Water heaters ⁷ and laundry stoves.		
Burning solid fuel	12	18
Burning liquid fuel	12	18 ²
Burning gas fuel	12	9 ⁴
Gas-steam and gas-hot water radiators	6	6 ³

Notes:

1. For other than the fire box side of a range burning solid fuel or the burner side of a range burning liquid fuel, the clearance at sides and rear may be 18 inches.

2. For liquid burning appliances that are approved specifically for installation with lesser clearances, flue pipes may be installed in accordance with the conditions of such approval.

3. This clearance does not apply to approved type B gas vents used and installed in accordance with the conditions of such approval.

4. This clearance may be reduced to 6 inches for gas burning appliances that have been tested by an approved agency and found to have flue gas temperatures not exceeding 550 F. This clearance does not apply to approved Type B gas vents that are used and installed in accordance with conditions of such approval.

5. A circulating type room heater is a room heater that has an outer jacket surrounding the casing around the combustion chamber, arranged with openings at top and bottom so that air circulates between the inner casing and the outer jacket. Room heaters that have openings in the outer jacket to permit some direct radiation from the inner casing shall be classed as radiating type.

6. Radiating type room heaters burning gas which make use of metal, asbestos or ceramic material to direct radiation to the front of the appliance shall have a clearance of 36 inches in front; those which have a double back of metal or ceramic material may be installed with clearance of 18 inches at sides and 12 inches in rear.

7. Combination heating stoves and water heaters shall be considered as room heaters.

3.4. Room heaters in sleeping quarters and in institutional occupancies.

Room heaters installed in sleeping quarters for use of transients or installed at any location in an institutional occupancy shall be of the vented type and shall be connected to an effective flue or vent. Gas burning room heaters shall be equipped with an automatic pilot.

SECTION 4. FLOOR FURNACES.

4.1. **Definition.** Floor furnace means a self-contained flue connected or vented unit furnace designed to be suspended from the floor of the space being heated, taking air for combustion outside this space, and with means for observing flame and lighting the appliance from such space.

4.2. Installation.

(a) Floor furnaces shall not be installed in floors constructed of combustible material unless approved specifically for such installation and installed in accordance with the conditions of such approval.

(b) **Support.** The floor around the floor furnace shall be braced and headed with a framework of material not lighter than the joists. Floor furnaces shall be supported independently of the floor grills.

(c) **Clearances.** The bottoms of floor furnaces shall have at least 6 inches clearance from the ground. Where the ground must be excavated to provide this clearance, the excavation shall extend at least 12 inches beyond the furnace on all sides and not less than 18 inches on the control side. Where such excavation exceeds 12 inches or the ground contour and ground moisture conditions are such that water may come to within 6 inches of the bottom of the floor furnace, a water-tight, properly anchored pan constructed of copper, galvanized iron, or other suitable corrosion resistant material, or a waterproof concrete pit shall be provided under the furnace. Sides of pan or pit shall extend 4 inches above ground level.

(d) **Access.** Floor furnaces shall be made readily accessible. Openings in foundation walls and trap doors in floors shall be not smaller than 18 by 24 inches. Under-floor passageways to the furnace shall be not less than 18 inches high by 24 inches wide.

(e) **Location of thermostat.** A thermostat controlling a floor furnace shall not be located in a room or space which can be separated from the room or space in which the register of the floor furnace is located.

(f) **Upper floor installation.** Floor furnaces shall not be installed in an upper floor of any building except that approved floor furnaces may be installed in upper floors, provided the furnace assembly projects below into a utility room, closet, garage or similar non-habitable space. In upper floor installations the furnace shall be enclosed completely (entirely separated from the non-habitable space) with means for air intake, with access facilities for servicing on the control side, with minimum furnace clearance of 6 inches to all sides and bottom, and with the enclosure constructed of portland cement plaster on metal lath or material of equal fire resistance.

(g) **Placement.** No floor furnace shall be installed in the floor of any aisle or passageway of any auditorium, public hall or place of assembly or in an exit way from any such room or space.

(h) With the exception of wall-register models, floor furnaces shall not be placed closer than 6 inches to the nearest wall. Wall-register models shall not be placed closer than 6 inches to a corner.

(i) Floor furnaces shall be so placed that a door, drapery, or similar object cannot be nearer than 12 inches to any portion of the register of the furnace.

4.3. Clearances for flue pipes and vent connectors.

(a) Floor furnace flue pipes and vent connectors, except as provided in paragraphs 4.3(b) and (c), shall be installed to provide clearances to woodwork or other combustible material not less than 9 inches.

(b) In the case of approved gas burning floor furnaces, the clearance from approved type B gas vent connectors to woodwork or other combustible material may be reduced in accordance with the conditions of such approval, provided that such clearance shall be not less than 3 inches for a distance of not less than 3 feet from the outlet of the draft hood measured along the center line of the vent connector.

(c) Floor furnace flue pipes and vent connectors may be installed with lesser clearances to woodwork or other combustible material provided the combustible material is protected as described in Table 2.3(b).

SECTION 5. UNIT HEATERS.

5.1. Definitions.

(a) **Unit heater** means a self-contained, automatically controlled heating appliance, intended for heating of nonresidential space in which it is installed, equipped with an integral means for circulation of air.

(b) **Steam or hot water unit heater** means a unit heater in which the heating element is supplied heat from a steam or hot water system.

(c) **Suspended type unit heater** means a unit heater which is suspended from the ceiling or mounted between uprights, or mounted on wall or column brackets.

(d) **Floor mounted unit heater** means a unit heater which is mounted on the floor of the space to be heated.

5.2. Floor mounted unit heaters.

Floor mounted unit heaters shall be installed as provided in section 2, Heating Furnaces and Boilers.

5.3. Suspended type unit heaters.

(a) Suspended type, unit heaters shall be safely and adequately supported with due consideration given to their weight and vibration characteristics. Hangers, brackets and other such supports shall be of noncombustible material.

(b) Suspended type, gas or liquid fuel burning or electric unit heaters, except as provided in paragraphs 5.3(c) and (d),

shall be installed to provide a clearance in any direction to woodwork or other combustible material of not less than 18 inches. The clearance from the flue pipe of such an appliance burning liquid fuel shall be not less than 18 inches to combustible material. The clearance from the vent connector of such an appliance burning gas shall be not less than 9 inches to combustible material, except that from vertical gas vent the clearance may be 6 inches, and approved type B gas vents may be used and installed in accordance with the conditions of such approval.

(c) Suspended type, gas or liquid fuel burning or electric unit heaters that are approved specifically for installation with lesser clearances than specified in paragraph 5.3(b) may be installed in accordance with the conditions of such approval.

(d) Suspended type, gas or liquid fuel burning unit heaters and their flue pipes or vent connectors, and electric unit heaters may be installed with lesser clearances to woodwork or other combustible material, provided the combustible material is protected as described in Table 2.3(b).

(e) Suspended type, gas or liquid fuel burning or electric unit heaters shall not be attached to a warm air duct system unless approved specifically for such installation and installed in accordance with the conditions of such approval.

5.4. Steam or hot water unit heaters.

Steam or hot water unit heaters shall be installed to provide clearances from all heated portions thereof to woodwork or other combustible material of not less than one inch.

SECTION 6. RECESSED HEATERS AND WALL HEATERS.

6.1. Definition.

Recessed heaters and wall heaters mean self-contained heating appliances designed for incorporation in or permanent attachment to a wall, partition, floor or ceiling of the room being heated.

6.2. Installation.

(a) Recessed heaters and wall heaters shall not be installed in or attached to walls, partitions, floors or ceilings constructed of combustible material unless approved specifically for such installation and installed in accordance with the conditions of such approval.

(b) Recessed heaters and wall heaters shall be so located as not to cause a fire hazard to walls, floors, curtains, furniture and doors.

(c) Panels, grilles and access doors which must be removed for normal servicing operations of recessed heaters and of wall heaters shall not be attached to the building construction.

SECTION 7. RESTAURANT TYPE COOKING APPLIANCES.**7.1. Definition.**

(a) **Restaurant type cooking appliances** shall include ranges, ovens, broilers, and other miscellaneous cooking appliances, of the types designed for use in restaurant and hotel kitchens.

(b) **Counter type appliances** shall include commercial hot plates and griddles, food and dish warmers, coffee brewers and urns, waffle bakers, hot water immersion sterilizers, and other heat producing appliances designed for counter installation in hotels and restaurants.

7.2. Floor mounted type—mounting.

(a) Floor mounted restaurant type cooking appliances, except as provided in paragraphs (b), (d), (e), (f) and (g) of this section 7.2, shall be mounted on floors of fire-resistive construction with noncombustible flooring and surface finish and with no combustible material against the underside thereof, or on fire-resistive slabs or arches having no combustible material against the underside thereof. Such construction shall in all cases extend not less than 12 inches beyond the appliance on all sides, and where solid fuel is used, such construction shall extend not less than 18 inches at the front or side where ashes are removed.

(b) Floor mounted restaurant type cooking appliances that are approved specifically for installation on a floor constructed of combustible material may be mounted in accordance with the conditions of such approval.

(c) Gas burning floor mounted restaurant type cooking appliances that are designed and marked "For use only in fire-resistive locations" shall be mounted only in accordance with paragraph 7.2(a).

(d) Floor mounted restaurant type cooking appliances which are set on legs that provide not less than 18 inches open space under the base of the appliance, or which have no burners and no portion of any oven or broiler within 18 inches of the floor, may be mounted on floors other than as specified in paragraph 7.2(a), provided there is at least one sheet metal baffle between the burners and the floor.

(e) Floor mounted restaurant type cooking appliances which are set on legs that provide not less than 8 inches open space under the base of the appliance may be mounted on floors other than as specified in paragraph 7.2(a), provided the floor under the appliance is protected with asbestos millboard not less than $\frac{3}{8}$ of an inch thick covered with sheet metal of not less than 24 gauge. The above specified floor protection shall extend not less than 6 inches beyond the appliance on all sides, and where solid fuel is used, such protection shall extend not less than 18 inches at the front or side where ashes are removed.

(f) Floor mounted restaurant type cooking appliances which are set on legs that provide not less than 4 inches open space under the base of the appliance may be mounted on floors other

than as specified in paragraph 7.2(a), provided the floor under the appliance is protected with hollow masonry not less than 4 inches thick covered with sheet metal of not less than 24 gauge. Such masonry shall be laid with ends unsealed and joints matched in such a way as to provide a free circulation of air through the masonry. Where solid fuel is used, the floor for 18 inches beyond the front of the appliance or side where ashes are removed shall be protected with asbestos millboard not less than $\frac{1}{4}$ of an inch thick covered with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

(g) Floor mounted restaurant type cooking appliances may be mounted on floors other than as specified in paragraph 7.2(a), provided the floor under the appliance is protected by two courses of 4-inch hollow masonry with courses laid at right angles and with ends unsealed and joints matched in such a way as to provide a free circulation of air through each masonry course. Such masonry shall be covered with a steel plate not less than $\frac{3}{16}$ of an inch thick. Where solid fuel is used, the floor for 18 inches beyond the front of the appliance or side where ashes are removed shall be protected with asbestos millboard not less than $\frac{1}{4}$ of an inch thick covered with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

7.3. Floor mounted type—clearances.

(a) Floor mounted restaurant type cooking appliances, except as provided in paragraphs (b), (d) and (e) of this section 7.3, shall be installed to provide a clearance to woodwork or other combustible material of not less than 18 inches at the sides and rear of the appliance and from the flue pipe or vent connector thereof, and not less than 48 inches above the cooking top and at the front of the appliance.

(b) Floor mounted restaurant type cooking appliances that are approved specifically for installation with lesser clearances than specified in paragraph 7.3(a) may be installed in accordance with the conditions of such approval.

(c) Gas burning, floor mounted restaurant type cooking appliances that are designed and marked "For use only in fire-resistive locations" shall not be installed elsewhere.

(d) Floor mounted restaurant type cooking appliances may be installed in rooms, but not in confined spaces such as alcoves or closets, with reduced clearances to woodwork or other combustible material, provided the combustible material or the appliance is protected as described in Table 2.3(b).

(e) Gas burning floor mounted restaurant type cooking appliances may be installed in rooms, but not in confined spaces such as alcoves, with reduced clearance of 6 inches to woodwork or other combustible material, provided the wall or combustible material is protected by sheet metal of not less than 26 gauge, fastened with noncombustible spacers that are spaced at not less than 2-foot vertical and horizontal intervals to provide a clearance of $1\frac{1}{2}$ inches from such wall or material. Such protection shall extend at least 12 inches beyond the back, side, top or any other

part of the appliance and the space between the sheet metal and wall or combustible material shall be open on both sides and top and bottom to permit circulation of air.

(f) Any portion of a wall or fixture that is constructed of combustible material and is adjacent to the cooking top section of a floor mounted restaurant type cooking appliance shall be protected as described in paragraph 7.3(e) for a distance of at least 2 feet above the surface of the cooking top, unless such portion of the wall or fixture is shielded from the cooking top section by a high shelf or warming closet. Such wall or fixture shall be protected even though the appliance is certified for "close-to-wall" installation.

7.4. Counter type gas burning appliances—mounting.

(a) Counter type appliances, except as provided in paragraph 7.4(b), shall not be set on combustible material unless they have legs which provide not less than 4 inches of open space below the burners, and the combustible surface is protected with asbestos millboard at least $\frac{1}{4}$ of an inch thick covered with sheet metal of not less than 28 gauge, or with equivalent protection.

(b) Counter type appliances that are approved specifically for mounting on combustible material shall be set on their own legs or bases and may be mounted in accordance with the conditions of such approval.

7.5. Counter type gas burning appliances—clearances.

(a) Counter type commercial hot plates and griddles, except as provided in paragraph 7.5(d) and (e), shall be installed to provide a horizontal clearance of not less than 18 inches to woodwork or other combustible material.

(b) Counter type food and dish warmers, except as provided in paragraphs 7.5(d) and (e), shall be installed to provide a horizontal clearance of not less than 6 inches to woodwork or other combustible material.

(c) Counter type appliances other than those mentioned in paragraphs 7.5(a) and (b), except as provided in paragraphs 7.5(d), and (e), shall be installed to provide a horizontal clearance of not less than 12 inches to woodwork or other combustible material.

(d) Counter type appliances that are approved specifically for such installations may be installed with a minimum horizontal clearance of not less than 6 inches to woodwork or other combustible material.

(e) Counter type appliances may be installed with reduced clearances to woodwork or other combustible material provided the combustible material is protected as described in Table 2.3(b).

(f) Counter type commercial hot plates and griddles shall be installed to provide a vertical clearance of not less than 48 inches above the top to woodwork or other combustible material.

7.6. Portable baking and roasting ovens — mounting and clearances.

(a) Portable baking and roasting ovens shall be mounted in accordance with the requirements for domestic type heating and cooking appliances in section 3.2.

(b) Portable baking and roasting ovens shall be installed to provide clearances to woodwork or other combustible material in accordance with section 7.3.

7.7. Gas appliance vents.

Vents of gas burning appliances installed under a hood conforming to section 10 may discharge into the space under the hood. Such vents shall terminate 18 inches from any grease filter or screen installed in the hood.

SECTION 8. INDUSTRIAL FURNACES AND POWER BOILERS, STATIONARY TYPE.

8.1. Classification.

Stationary type industrial furnaces and power boilers shall be classified as low, medium or high heat appliances in accordance with their character and size and the temperatures developed in the portions thereof where substances or materials are heated for baking, drying, roasting, melting, vaporizing or other purpose. Where a furnace is not specifically classified in this section or there is any uncertainty as to its classification, it shall be placed in the class that most nearly resembles it with respect to character and size and the temperatures developed in the portions thereof where substances or materials are heated.

(a) **Low heat appliances** shall include furnaces developing temperatures up to 600 F. in the portions where substances or materials are heated, steam boilers operating at not over 50 pounds per square inch gauge pressure, and steam boilers of not over 10 boiler horsepower regardless of operating pressure. Appliances otherwise classed as medium heat appliances may be considered as low heat appliances if not larger than 100 cubic feet in size.

(b) **Medium heat appliances** shall include furnaces developing temperatures between 600 F. and 1500 F. in the portions where substances or materials are heated, and steam boilers of over 10 boiler horsepower operating at over 50 pounds per square inch gauge pressure. Appliances otherwise classed as high heat appliances may be considered as medium heat appliances if not larger than 100 cubic feet in size.

(c) **High heat appliances** shall include furnaces developing temperatures above 1500 F. in the portions where substances or materials are heated.

(d) Following are lists of industrial furnaces classified as low, medium and high heat appliances.

Low	MEDIUM	HIGH
1. Annealing Baths for hard glass (fats, paraffine, salts, or metals).	1. Alabaster Gypsum Kilns.	1. Bessemer Retorts.
2. Bake Ovens (in bakeries).	2. Annealing Furnaces (glass or metal).	2. Billet and Bloom Furnaces.
3. Boiling Vats, for wood fibre, straw, lignin, etc.	3. Charcoal Furnaces.	3. Blast Furnaces.
4. Candy Furnaces.	4. Cold Stirring Furnaces.	4. Bone Calcining Furnaces.
5. Coffee Roasting Ovens.	5. Feed Driers (direct fire heated).	5. Brass Furnaces.
6. Core Ovens.	6. Fertilizer Driers (direct fire heated).	6. Carbon Point Furnaces.
7. Cruller Furnaces.	7. Galvanizing Furnaces.	7. Cement Brick and Tile Kilns.
8. Feed Drying Ovens.	8. Gas Producers.	8. Coal and Water Gas Retorts.
9. Fertilizer Drying Ovens.	9. Hardening Furnaces (cherry to pale red).	9. Cupolas.
10. Forge Furnaces (solid fuel).	10. Lehrs and Glory Holes.	10. Earthenware Kilns.
11. Gypsum Kilns.	11. Lime Kilns.	11. Glass Blow Furnaces.
12. Hardening Furnaces (below dark red).	12. Linseed Oil Boiling Furnaces.	12. Glass Furnaces (smelting).
13. Hot Air Engine Furnaces.	13. Porcelain Biscuit Kilns.	13. Glass Kilns.
14. Ladle Drying Furnaces.	14. Pulp Driers (direct fire heated).	14. Open Hearth Furnaces.
15. Lead Melting Furnaces.	15. Steam Boilers of over 10 boiler horsepower and operating at over 50 lb. per sq. in. gauge pressure.	15. Ore Roasting Furnaces.
16. Nickel Plate (drying) Furnaces.	16. Water-glass Kiln.	16. Porcelain Baking and Glazing Kilns.
17. Paraffine Furnaces.	17. Wood-distilling Furnaces.	17. Pot-arches.
18. Recuperative Furnaces (spent materials).	18. Wood-gas Retorts.	18. Puddling Furnaces.
19. Rendering Furnaces.		19. Regenerative Furnaces.
20. Rosin Melting Furnaces.		20. Reverberatory Furnaces.
21. Steam Boilers operating at not over 50 lb. per sq. in. gauge pressure; and Steam Boilers of not over 10 boiler horsepower, including Pressing Machine Boilers.		21. Stacks, Carbureter or Superheating Furnaces (in water gas works).
22. Stereotype Furnaces.		22. Welding Furnaces.
23. Sulphur Furnaces.		23. Wood Carbonizing Furnaces.
24. Tripoli Kilns (clay, coke and gypsum).		
25. Type Foundry Furnaces.		
26. Wood Drying Furnaces.		
27. Wood Impregnating Furnaces.		
28. Zinc Amalgamating Furnaces.		

8.2. Low heat appliances—mounting.

(a) Except as provided in paragraphs 8.2(b), (c), (d) and (e), low heat appliances shall be mounted on the ground, or on floors of fire-resistive construction with noncombustible flooring or surface finish and with no combustible material against the underside thereof, or on fire-resistive slabs or arches having no combustible material against the underside thereof. Such construction shall in all cases extend not less than 12 inches beyond the appliance on all sides, and where solid fuel is used shall extend not less than 18 inches at the front or side where ashes are removed.

(b) Low heat appliances which are approved specifically for installation on a floor constructed of combustible material may be mounted in accordance with the conditions of such approval.

(c) Low heat appliances which are set on legs that provide not less than 18 inches open space under the base of the appliance may be mounted on floors other than as specified in paragraph 8.2(a), provided there is at least one sheet metal baffle between any burners and the floor, and further provided the appliance is so arranged that flame or hot gases do not come in contact with its base. Where solid fuel is used, the floor under the appliance and for 18 inches beyond the front of the appliance or side where ashes are removed shall be protected with asbestos millboard not

less than $\frac{1}{4}$ of an inch thick covered with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

(d) Low heat appliances which are set on legs that provide not less than 4 inches open space under the base of the appliance may be mounted on floors other than as specified in paragraph 8.2(a), provided the appliance is so arranged that flame or hot gases do not come in contact with its base, and further provided the floor under the appliance is protected with hollow masonry not less than 4 inches thick covered with sheet metal of not less than 24 gauge. Such masonry shall be laid with ends unsealed and joints matched in such a way as to provide a free circulation of air from side to side through the masonry. Where solid fuel is used, the floor for 18 inches beyond the front of the appliance or side where ashes are removed shall be protected with asbestos millboard not less than $\frac{1}{4}$ of an inch thick covered with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

(e) Low heat appliances may be mounted on floors other than as specified in paragraph 8.2(a), provided the floor under the appliance is protected by two courses of 4-inch hollow masonry that are laid at right angles and with ends unsealed and joints matched in such a way as to provide a free circulation of air through such masonry courses. Such masonry shall be covered with a steel plate not less than $\frac{3}{16}$ of an inch thick. Where solid fuel is used, the floor for 18 inches beyond the front of the appliance or side where ashes are removed shall be protected with asbestos millboard not less than $\frac{1}{4}$ of an inch thick covered with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

8.3. Low heat appliances—clearances.

(a) Except as provided in paragraphs 8.3(b) and (c), low heat appliances shall be installed to provide a clearance to woodwork or other combustible material, of not less than 18 inches above and at the sides and rear and not less than 48 inches at the front of the appliance, and of not less than 18 inches from the flue pipe or vent connector thereof, provided that for a low heat appliance encased in brick, the clearance above and at the sides and rear may be 12 inches. A clearance of not less than 12 inches shall be provided from low heat appliances to walls or ceilings of noncombustible construction which have combustible material placed on the outer or upper sides thereof, or which due to occupancy may have combustible material so placed.

(b) Low heat appliances which are approved specifically for installation with lesser clearances than specified in paragraph 8.3(a), may be installed in accordance with the conditions of such approval.

(c) Low heat appliances and their flue pipes or vent connectors may be installed with reduced clearances to woodwork or other combustible material, provided the combustible material or the appliance is protected as described in Table 2.3(b)

8.4. Medium heat appliances.

(a) Except as provided in paragraph 8.4(b), medium heat appliances shall be mounted on the ground or on floors of fire-resistive construction with noncombustible flooring and surface finish and with no combustible material against the underside thereof, or on fire-resistive slabs or arches having no combustible material against the underside thereof. Such construction shall extend not less than 3 feet beyond the appliance on all sides, and where solid fuel is used, it shall extend not less than 8 feet at the front or side where ashes are removed.

(b) Medium heat appliances which are set on legs that provide not less than 24 inches open space under the base of the appliance may be mounted on floors other than as specified in paragraph 8.4(a), provided the floor under the appliance is protected with hollow masonry not less than 4 inches thick covered with sheet metal of not less than 24 gauge.

(c) Medium heat appliances shall be installed to provide a clearance to woodwork or other combustible material of not less than 36 inches at the sides and rear, and not less than 48 inches above, and not less than 8 feet at the front of the appliance, and not less than 36 inches from the flue pipe or vent connector thereof, provided that for a medium heat appliance encased in brick the clearance above may be 36 inches and at the sides and rear it may be 18 inches. A clearance of not less than 24 inches shall be provided from medium heat appliances to walls or ceilings of noncombustible construction which have combustible material or construction placed on the outer or upper sides thereof, or which due to occupancy may have combustible material so placed.

(d) Rooms containing medium heat appliances shall be provided with means of ventilation adequate to prevent accumulation of hot air over the appliance.

8.5. High heat appliances.

(a) High heat appliances shall be mounted on the ground, or on floors of fire-resistive construction with noncombustible flooring or surface finish and with no combustible material or construction against the underside thereof. Such floors shall extend not less than 10 feet beyond the appliance on all sides and not less than 30 feet at the front or side where hot products are removed.

(b) High heat appliances shall be installed to provide a clearance to woodwork or other combustible material, of not less than 10 feet at the sides and rear, and not less than 15 feet above, and not less than 30 feet at the front or side where hot products are removed.

(c) Rooms containing high heat appliances shall be provided with means of ventilation adequate to prevent accumulation of hot air over or near the appliance.

SECTION 9. APPLIANCE CONNECTIONS TO CHIMNEYS OR VENTS.**9.1. Appliances required to be flue connected or vented.**

(a) Every heat producing appliance burning solid or liquid fuel shall be connected to a chimney that is suitable and safe for such use, and every gas burning appliance shall be connected to a chimney or gas vent that is suitable and safe for such use, except that appliances covered by paragraphs (b), (c), (d) and (f) of this section 9.1, may be installed without connection to a chimney or vent. Chimneys and gas vents constructed and used in accordance with Article X of the National Building Code recommended by the National Board of Fire Underwriters shall be considered as suitable and safe for use as prescribed therein.

(b) Kerosene heaters and stoves that are approved specifically for use without a flue connection, may be installed in accordance with the conditions of such approval, except such heaters and stoves shall not be installed in sleeping quarters and in institutional occupancies. See paragraph 3.4.

(c) Gas burning ranges, hot plates, laundry stoves and domestic clothes dryers that are approved specifically for use without a vent, may be installed in accordance with the conditions of such approval.

(d) Gas burning water heaters with inputs not over 5,000 Btu per hour, gas refrigerators, counter appliances, room heaters except when installed in sleeping quarters and in institutional occupancies, and other gas burning appliances not provided with flue collars that are approved specifically for unvented use may be installed in accordance with conditions of such approval, except as provided by paragraph 9.1(e).

(e) When any or all of the appliances listed in paragraph 9.1(d) are installed so that the aggregate input rating exceeds 30 Btu per hour per cubic foot of room or space in which they are installed, they shall be flue or vent connected or provided with approved means for exhausting the flue gases to the outside atmosphere. Where the room or space in which they are installed is directly connected to another room or space by a doorway, archway, or other opening of comparable size, which cannot be closed, the volume of such adjacent room or space may be included in the calculations.

(f) Industrial appliances which are designed for use without a connection to a chimney or vent and which do not create a health or fire hazard may be installed without such connection when the installation is in accordance with accepted engineering practices.

9.2. Flue pipes and vent connectors.

(a) Materials. Flue pipes and vent connectors shall be made of noncombustible material capable of withstanding the flue gas temperatures of the appliances and of sufficient thickness to withstand physical damage. The material of vent connectors shall also be resistant to corrosion.

(b) Support. Flue pipes and vent connectors shall be securely supported.

(c) Pitch. Flue pipes and vent connectors shall maintain a pitch or rise of at least $\frac{1}{4}$ inch to the foot (horizontal length) from the appliance to the chimney or vent.

(d) Size. The flue pipe or vent connector shall not be smaller than: (1) the size of the flue collar of the appliance, (2) the size recommended by the appliance manufacturer, or (3) the size of the outlet of the draft hood that is supplied by the manufacturer of the gas burning appliance.

(e) Passage through floors or ceilings. No flue pipe or vent connector shall pass through any floor or ceiling.

(f) Passage through walls. No flue pipe or vent connector of any medium or high heat appliance as classified in section 8, shall pass through any wall or partition constructed of combustible material.

(g) Flue pipes of liquid or solid fuel burning appliances other than those for medium or high heat appliances as classified by section 8, shall not pass through walls or partitions constructed of combustible material unless they are guarded at the point of passage by:

(1) metal ventilated thimbles not less than 12 inches larger in diameter than the flue pipe or vent connector; or

(2) metal or burned fire clay thimbles built in brickwork or other approved fireproofing materials extending not less than 8 inches beyond all sides of the thimble; or

(3) in lieu of such protection all combustible material in the wall or partition shall be cut away from the flue pipe or vent connector a sufficient distance to provide the clearance required from such flue pipe or vent connector. Any material used to close up such opening shall be noncombustible.

(h) Vent connectors for gas burning appliances other than those of type B and those for medium and high heat appliances as classified by section 8, shall not pass through walls or partitions constructed of combustible material unless they are guarded at the point of passage by ventilated metal thimbles not smaller than the following:

(1) For gas burning appliances, except floor furnaces and incinerators, that have been tested by an approved agency and found to have flue gas temperatures not exceeding 550 F.—4 inches larger in diameter than the vent connector, unless there is a run of not less than 6 feet of vent connector in the open between the draft hood outlet and the thimble, in which case the thimble may be 2 inches larger than the vent connector;

(2) For gas burning floor furnaces and for all gas burning appliances, except incinerators, that have not been tested by an approved testing agency—6 inches larger in diameter than the vent connector;

(3) For incinerators—12 inches larger in diameter than the vent connector.

(i) Clearances. For flue pipe and vent connector clearances see the sections dealing with clearances for individual types of appliances.

9.3. Interconnection of flue pipes and vent connectors.

No flue or vent connector from a gas burning appliance shall be connected to a flue which serves appliances burning either liquid or solid fuel, unless such appliance is equipped with an automatic pilot. The automatic pilot shall automatically shut off the gas supply to the burner or burners being served when the pilot is extinguished. For liquefied petroleum gases, the automatic pilot shall automatically shut off the gas supply to the pilot as well as to the main burners.

9.4. Dampers.

(a) Manually operated dampers shall not be placed in flue pipes or vent connectors of liquid or gas burning appliances except as given in paragraph 9.4(b). Fixed baffles on the appliance side of draft hoods and draft regulators shall not be classified as dampers.

(b) A manually operated or barometric damper may be installed in the flue pipe of a gas incinerator when recommended by the manufacturer. Such manual damper shall be so constructed that it will not close off more than 80 per cent of the cross-sectional area of the flue pipe.

9.5. Draft regulators.

(a) A draft regulator shall be provided in the flue pipe of each liquid fuel burning appliance unless the burner is approved for use without one.

(b) A draft regulator when used shall be installed in the same room or enclosure as the appliance and in such a manner that no difference in pressure between the air in the vicinity of the regulator and the combustion air supply will be permitted.

9.6. Draft hoods.

(a) A draft hood shall be provided for each vented gas burning appliance except incinerators, dual oven type combination ranges, units designed for power burners or forced venting and industrial appliances which require positive draft. If the draft hood is not a part of the appliance or supplied by the manufacturer, it shall be the same size as the appliance flue collar unless the manufacturer's instructions state otherwise.

(b) Where the draft hood is a part of the appliance or is supplied by the appliance manufacturer it shall be installed without alteration and in accordance with the manufacturer's instructions. In the absence of manufacturer's instructions, the draft hood shall be attached to the flue collar of the appliance or as near to the appliance as conditions permit. In no case shall a draft hood be installed in a false ceiling, in a different room, or

in any manner that will permit a difference in pressure between the draft hood relief opening and the combustion air supply.

(c) A draft hood shall be installed in the position for which it was designed with reference to the horizontal and vertical planes and shall be so located that the relief opening is not obstructed by any part of the appliance or adjacent construction.

9.7. Flue exhausters.

Flue exhausters may be used with gas burning appliances in lieu of natural draft vents except on incinerators. Where a flue exhauster is used with gas burning appliances requiring venting, provisions shall be made to prevent the flow of gas to the main burners in the event of failure of the exhaust system.

SECTION 10. VENTILATING HOODS.

10.1. Required locations.

Commercial cooking appliances such as restaurant type ranges, deep fat fryers, broilers, and roasting ovens, candy kettles, cruller furnaces, and commercial and industrial appliances that present a fire hazard similar to commercial frying operations shall be provided with ventilating hoods and exhaust ducts; unless such appliances are enclosed and vented in an approved manner.

10.2. Materials and installation.

(a) Hoods shall be constructed of approved noncombustible materials with tight joints.

(b) Hoods shall not be raised more than seven feet above the floor. The width and breadth of hoods shall be not less than that of the appliance served.

(c) Hoods, except as provided in paragraph 10.2(d), shall be installed to provide a clearance of not less than 18 inches to woodwork or other combustible material.

(d) Hoods may be installed with reduced clearances to woodwork or other combustible material, provided the combustible material is protected as described in Table 2.3(b).

10.3. Exhaust ducts.

(a) Independent system. Exhaust ducts shall constitute an independent exhaust system leading to the outside and shall not be connected with any other ventilating system.

(b) Materials. Exhaust ducts shall be constructed of not less than 18 gauge steel or of 20 gauge stainless steel.

(c) Joints. Exhaust duct joints shall be tight and inside laps shall project in a direction against the air flow.

(d) Clearance. Exhaust ducts, except as provided in paragraph 10.3(e), shall be installed to provide a clearance of not less than 18 inches to woodwork or other combustible material.

(e) Exhaust ducts may be installed with reduced clearances to woodwork or other combustible material, provided the combustible material is protected as described in Table 2.3(b).

(f) Passage through walls. Exhaust ducts shall not pass through any wall or partition constructed of combustible material unless they are guarded at the point of passage as required for flue pipes by paragraph 9.2(g).

(g) Exhaust ducts shall not pass through fire walls.

(h) Vertical risers. Vertical riser portions of exhaust ducts if located inside the building shall be enclosed in a shaft constructed of 4-inch hollow masonry extending continuously from the first floor pierced through the roof. Vertical risers that extend directly from the space in which the hood is located through the roof without passing through any attic or concealed space may be installed without such enclosure if installed in accordance with requirements for a metal chimney passing through a combustible roof.

(i) At the base of each vertical riser a residue trap with provisions for clean out shall be provided.

10.4. Gas appliance vents.

Vents of gas burning appliances may discharge into the space under the hood. Such vents shall terminate 18 inches from any grease filter or screen installed in the hood.

SECTION 11. STEAM AND HOT WATER PIPES.

11.1. Clearances.

(a) Steam pipes and hot water pipes shall be installed with a clearance of at least one inch to all combustible material except as specified in paragraphs (b) and (c) of this section 11.1.

(b) At points where pipes carrying steam or hot water at not over 15 pounds per square inch gauge pressure emerge from a floor, wall or ceiling, the clearance at the opening through the finish floor boards or wall or ceiling boards may be less than one inch but shall not be less than $\frac{1}{2}$ of an inch. Each such opening shall be covered with a plate of noncombustible material.

(c) Hot water pipes on a system with automatic firing and with limit controls such that water temperature at the boiler or furnace cannot rise above 150 F. may be installed with no clearance to combustible material.

11.2. Protection.

(a) Steam pipes and hot water pipes passing through stock shelving shall be covered with approved insulation not less than 1 inch thick.

(b) Wooden boxes or casings enclosing steam or hot water heating pipes, or wooden covers to recesses in walls in which such pipes are placed shall be lined with sheet metal of not less than 28 gauge or asbestos millboard not less than $\frac{1}{4}$ of an inch thick.

(c) Coverings or insulation used on steam or hot water pipes shall be of noncombustible material.

(d) Where steam pipes and hot water pipes pass through a floor, wall or ceiling of fire-resistive construction, the openings around them shall be filled with noncombustible material to prevent the passage of fire.

11.3. Antifreeze solutions for radiant heating coils.

Antifreeze solutions used in radiant heating coils shall not contain any liquid with a flash point less than 225 F.

SECTION 12. RESIDENCE TYPE WARM AIR HEATING AND AIR CONDITIONING SYSTEMS.

12.1. Application.

This section applies to residence type central warm air heating systems including combination heating and air conditioning systems. This section does not apply to other air conditioners in which no heating is incorporated, or to heat pumps.

12.2. Definitions.

(a) **Central warm air heating system** means a heating system consisting of a heat exchanger with an outer casing or jacket, or an electric heating unit, connected to a supply system and a return system.

(b) **Forced air system** means a central warm air heating system that is equipped with a fan or blower which provides the primary means for circulation of air.

(c) **Gravity system** means a central warm air heating system through which air is circulated by gravity. It may also use an integral fan or blower that is used only to overcome the internal furnace resistance to air flow.

(d) **Heat exchanger** means a chamber in which heat resulting directly from combustion of fuel or heat from a medium such as air, water or steam is transferred through the walls of the chamber to the air entering the supply system.

(e) **Plenum** means an air compartment or chamber to which one or more ducts are connected and which forms part of either the supply or return system.

(f) **Return system** means an assembly of connected ducts, air passages or plenums and fittings through which air from the space or spaces to be heated is conducted back to the heat exchanger.

(g) **Supply system** means an assembly of connected ducts, air passages or plenums and fittings through which air, heated in a heat exchanger, is conducted from the heat exchanger to the space or spaces to be heated.

12.3. Supply ducts—construction.

(a) **Duct material.** Except as permitted by paragraphs 12.3(a)(3) and (4), supply ducts shall be constructed entirely of noncombustible material equivalent in structural strength and durability to the following:

(1) Ducts Not Enclosed in Partitions:

Round Ducts

Diameter, Inches	Minimum Thickness Galv. Iron U. S. Gauge	Minimum Thickness Aluminum B & S Gauge	Minimum Weight of Tin Plate
Less than 12	30	26	IC (107 lb.)
12 or more	28	26	IX (135 lb.)

Rectangular Ducts

Width, Inches	Minimum Thickness Galv. Iron U. S. Gauge	Minimum Thickness Aluminum B & S Gauge
Less than 14	28	26
14 or more	26	24

(2) Ducts Enclosed in Partitions:

Rectangular Ducts

Width, Inches	Minimum Thickness Galv. Iron U. S. Gauge	Minimum Thickness Aluminum B & S Gauge	Minimum Weight of Tin Plate
14 or less	30	26	IC (107 lb.)
Over 14	28	26	IX (135 lb.)

(3) Supply ducts that are completely encased in not less than 2 inches of concrete in a floor slab need not be constructed of noncombustible material except those portions that are within 2 feet of the vertical supply plenum and within 2 feet of a connection to a vertical riser or register.

(4) Vibration isolation connectors in duct systems shall be made of woven asbestos or approved flameproofed fabric or shall consist of sleeve joints with packing of rope asbestos or other approved noncombustible material. Vibration isolation connectors of flameproofed fabric shall not exceed 10 inches in length.

(b) Duct joints. Joints and seams of supply ducts shall be securely fastened and made substantially air tight. Slip joints shall have a lap of at least one inch and shall be individually fastened. Tape used for sealing joints shall be not more combustible than approved flameproofed fabric.

(c) Duct hangers. Supply ducts shall be securely supported by metal hangers, straps, lugs or brackets. No nails shall be driven through the duct walls and no unnecessary holes shall be cut therein.

(d) Firestopping. Where the installation of supply ducts in walls, floors, or partitions requires the removal of any firestopping, the spaces around the duct at such points where firestopping was removed shall be sealed with asbestos, mineral wool, or other noncombustible insulating material.

(e) Covering of exposed vertical supply ducts. Where vertical supply ducts are exposed in closets or rooms, the ducts shall be covered with approved air cell asbestos not less than $\frac{1}{4}$ of an inch thick or other equivalent fire-resistant insulation.

(f) Registers for ducts. Warm air furnace systems, other than systems which are automatically fired with liquid or gas fuel, or electricity and have approved temperature limit controls, shall have at least one register or grille without a closeable shutter and the duct leading thereto shall be without a damper, except where dampers and shutters cannot shut off more than 80 per cent of the duct area.

12.4. Clearances from horizontal supply ducts.

(a) Where ducts are adjacent to plaster on metal lath or to other noncombustible material attached to a combustible material, the clearance shall be measured to the combustible material, except that the clearance shall be measured to the surface of the plaster or other noncombustible finish where a clearance of 1 inch or 2 inches is specified above supply ducts within the distance from the plenum specified in paragraphs 12.4(b) (1) and (2). This shall not be construed to prohibit closure of openings with noncombustible material where ducts pass through walls and partitions, as provided in paragraph 12.4(b) (6).

(b) Minimum clearances from horizontal supply ducts shall be as follows:

(1) Within a distance of 3 feet of the plenum of a system classified under Items I and III of Table 2.3(a), the clearance shall be not less than specified above the bonnet or plenum.

(2) Within a distance of 6 feet of the plenum of a system classified under Items II, IV and VI of Table 2.3(a), the clearance shall be not less than specified above the bonnet or plenum.

(3) Beyond the distance from the plenum specified in paragraphs 12.4(b) (1) and (2), no clearance is required except as provided in paragraphs 12.4(b) (4) and (5).

(4) From ducts of furnaces classified under Item IV of Table 2.3(a), the clearance shall be not less than 6 inches out to 6 feet and one inch beyond 6 feet to a point where there is a change in direction equivalent to 90 degrees or more.

(5) From ducts of furnaces that require 18-inch clearance above the bonnet or plenum (see Table 2.3(a)), the clearance shall be not less than 18 inches out to 3 feet, not less than 6 inches from 3 feet to 6 feet, and not less than one inch beyond 6 feet.

(6) Where a horizontal supply duct passes through or pierces a partition or enclosure constructed of combustible material, the clearance shall be not less than specified in paragraphs 12.4(b) (1), (2), (4) and (5). The ends of the space providing this clearance may be closed with a thimble and collar, or the wall surfaces extended to the duct with noncombustible building material such as plaster on metal lath.

12.5. Clearances from vertical ducts, risers, boots and register boxes.

(a) Where a duct, riser, boot or box on a system that does not require 18-inch clearance above the supply plenum or bonnet enters a floor, partition or enclosure constructed of combustible material within the distance from the plenum specified in paragraphs 12.4(b) (1) and (2), the clearance from such duct, riser or boot shall be not less than the distance required above the furnace bonnet or plenum (see Table 2.3(a)), or the duct shall change direction equivalent to at least two 90 degree turns before entering such floor, partition, or enclosure. The above does not apply to pipeless furnaces covered in paragraph 12.6.

(b) Where a supply duct enters the floor of the first story above that in which the furnace is located, the space around the duct at such points shall be sealed with asbestos cement or other noncombustible material.

(c) Where a duct, riser, boot or box on a system that requires 18-inch clearance above the supply plenum or bonnet enters a floor, partition, or enclosure constructed of combustible material within a horizontal distance of 6 feet of the furnace, the duct shall be so arranged that heated air must travel at least 6 feet from the closest primary heating surface and change direction equivalent to at least one 90 degree turn before entering such floor, partition or enclosure.

(d) Where a duct, riser, boot or box on a system that requires 18-inch clearance above the supply plenum or bonnet enters the floor of the first story above that in which the furnace is situated, the clearance shall be at least $3/16$ of an inch from all combustible material in the floor construction, unless the duct is of double wall construction with a continuous air space of not less than $3/16$ of an inch between the inner and outer walls.

(e) Where a duct or riser on a system that requires 18-inch clearance above the supply plenum or bonnet is enclosed in a partition, wall, or concealed space constructed of combustible material:

(1) Such duct shall be installed with an air space of not less than $3/16$ of an inch between the duct and the combustible material, unless a noncombustible insulating covering of cellular type at least $1/8$ inch thick is provided (in metal lath and plaster partitions no air space is needed except from wood studs);

(2) Or, such duct shall be made double with a continuous air space of not less than $3/16$ of an inch between the inner and outer walls.

(f) Where a register on a system that requires 18-inch clearance above the supply plenum or bonnet is placed in a floor or wall constructed of combustible material, the register box shall be installed with a clear space of not less than $3/16$ inch between the top and sides of the box and any combustible material.

12.6. Pipeless furnace registers.

Where registers are installed in the floor over the furnace (as in the "pipeless" furnace), the register box shall be constructed double with an air space not less than 4 inches between, except where the warm air passage is surrounded by a cold air passage.

12.7. Heating panels.

Air chambers, having one or more external surfaces designed for use as heating panels shall comply with the following:

(a) Use. Heating panels shall be used only with:

(1) Automatically fired gas or oil burning forced warm air systems equipped with temperature limit controls that cannot be set above 200 F.;

(2) Or, forced warm air systems equipped with heat exchangers utilizing steam which cannot exceed 15 pounds gauge pressure or hot water which cannot exceed a temperature of 250 F.

(b) Connection. Heating panels shall be connected to supply ducts conforming to section 12.3 and return air ducts conforming to section 12.8.

(c) Construction.

(1) Where warm air supply is from a warm air furnace, heating panels shall be enclosed on all sides with material which is wholly noncombustible or which possesses a flame spread rating of not over 20 as determined in accordance with the Method for Fire Hazard Classification of Building Materials, ASTM E84, Underwriters Laboratories, Inc., Standard. This enclosing material shall be securely attached to the building structure; joints and seams shall be substantially air tight. Braces and hangers inside the chamber shall be noncombustible.

(2) Where warm air supply is from a steam or hot water heat exchanger, heating panels shall either comply with paragraph 12.7(c)(1), or shall be enclosed on all sides with material not more flammable than 1-inch wood boards. This enclosing material shall be securely attached to the building structure; joints and seams shall be substantially air tight. No single vertical heating panel shall serve more than one story.

12.8. Return ducts.

(a) Duct material.

(1) Return ducts, except as required by paragraph 12.8(a)(2), may be constructed of metal, of one-inch (nominal) wood boards, or other suitable material, provided that no material more flammable than one-inch boards shall be used.

(2) Portions of return ducts directly above the heating surface, or closer than 2 feet from the outer jacket or casing of the heater shall be constructed in accordance with provisions of paragraph 12.3 for supply ducts.

(3) The interior of combustible ducts shall be lined with noncombustible material at points where there might be danger from incandescent particles dropped through the register or heater, such as directly under floor registers and the bottom of vertical ducts or directly under heaters having a bottom return.

(b) Firestopping.

(1) Where return ducts are installed in walls, floors or partitions, their installation shall comply with the provisions of paragraph 12.3(d).

(2) Where spaces between studs in walls or partitions are used as ducts, the portions of such spaces so used shall be cut off from all remaining unused portions by tight fitting stops of sheet metal or of wood not less than 2 inches (nominal) thick.

(c) Duct openings. No vertical duct shall have openings to receive return air on more than one floor.

(d) Continuous ducts.

(1) Return air shall be conducted to the heater through continuous ducts, except as indicated in paragraphs 12.8(d) (2) and (3).

(2) Underfloor spaces may be used as ducts for return of air from rooms directly above, provided such spaces are not over 2 feet in height to bottom of floor joists and are cleaned of all combustible material and are tightly and substantially enclosed.

(3) In a single story residence, the return air may travel through the first floor living space to furnace air inlet grilles located at or above the first floor level.

(e) Public hall as plenum. Public halls or public stairways shall not be used as plenums.

(f) Negative pressure from circulating fan. The return system shall be arranged so that negative pressure from the circulating fan cannot affect the air supply for combustion or act to draw products of combustion from joints or openings in the furnace or flue.

12.9. Air cooling equipment.

(a) Installation. Mechanical refrigeration used with air duct systems shall be installed in accordance with nationally recognized safe practices. Installations conforming to the American Standard Safety Code for Mechanical Refrigeration, ASA-B9.1, shall be considered as meeting these requirements.

(b) Cooling and heating units in series or parallel.

(1) Heating furnaces of the combustion type shall not be located downstream from cooling units unless the furnace is approved for such use.

(2) Heating furnaces shall not be located upstream from cooling units unless the cooling unit is designed or equipped so as not to develop excessive temperature or pressure.

(3) Heating furnaces may be installed in parallel with cooling units by use of dampers located to direct the air to either the furnace only, or to the cooling unit only, as desired.

SECTION 13. AIR CONDITIONING, WARM AIR HEATING, AIR COOLING AND VENTILATING SYSTEMS, OF OTHER THAN RESIDENCE TYPE.

13.1. Application.

This section applies to air duct systems employing mechanical means for the movement of air and used for heating and ventilating, including air conditioning systems, combination heating and ventilating systems, exhaust systems, plain ventilating systems, and warm air heating systems, except that it does not apply to residence type systems nor to systems for removal of flammable vapors and residues nor to systems for conveying dust, stock or refuse by means of air currents.

13.2. Construction of ducts.

(a) Ducts shall be constructed entirely of noncombustible material, such as iron, steel, aluminum or other approved material.

(b) Ducts shall be so constructed as to provide structural strength and durability at least the equivalent of materials of the thicknesses specified in the table below, except that spirally wound ducts, under 6 inches in diameter may be of 30 U. S. gauge steel. Wired glass may be used for inspection windows in ducts.

Thickness of Metal for Air Ducts.

Round Ducts Diameter (Inches)	Rectangular Ducts Max. Side (Inches)	Minimum Thickness of Steel U. S. Gauge	Minimum Thickness of Aluminum B & S Gauge
Up to 13	Up to 12	26	24
14 to 33½	13 to 30	24	22
34 to 67½	31 to 60	22	20
	61 to 90	20	18
	91 and above	18	16

(c) Ducts may be of independent construction or may be formed by parts of the building structure, provided that they conform to the requirements of this section. Construction consisting of not less than ¾-inch cement or gypsum plaster on metal lath applied to either combustible or noncombustible supports may be used as duct walls.

(d) Flexible duct connectors for use between ducts and air outlets or air outlet units need not conform to the requirements for ducts if they conform to the following provisions and are approved for this use:

(1) They shall be made from a base material of metal or mineral.

(2) They shall not be subject to deterioration from mildew or moisture.

(3) They shall not be more combustible than approved flameproofed fabric.

(4) They shall not exceed 12 feet in length.

(5) They shall not exceed 8 inches in diameter.

(6) They shall not pass through any fire wall, required two-hour partition, or floor.

(7) They shall be covered with not less than one-half inch of noncombustible insulating material or shall be located in an enclosure constructed of noncombustible material.

(e) Vibration isolation connectors in duct systems, other than as covered by paragraph 13.2(f), shall be made of woven asbestos or approved flameproofed fabric or shall consist of sleeve joints with packing of rope asbestos or other approved noncombustible material. Vibration isolation connectors of fabric shall not exceed 10 inches in length.

(f) A vibration isolation connector at the joint between duct and fan where the inlets to the fan, if of exhaust type, or the outlets from the fan are in the same room or enclosure as the joint shall be exempt from paragraph 13.2(e) if not over 10 inches in length.

(g) Only approved fire-resistive linings shall be used inside of ducts.

(h) Combustible coverings shall not be used on the outside of ducts carrying air at a temperature above 175 F.

(i) Work involving the use of torches shall not be undertaken on ducts until the system has been shut down, the duct cleaned and all combustible lining and covering material has been removed from the portion of the duct being altered.

(j) Ducts shall be made reasonably tight throughout and shall have no openings other than those required for the proper operation and maintenance of the system.

(k) Tape used for sealing joints shall be not more combustible than approved flameproofed fabric.

13.3. Clean out openings in ducts.

(a) Return ducts, other than vertical, shall be so constructed that the interior is accessible for cleaning, except that accessibility is not required where all of the following conditions prevail:

(1) The occupancy is not productive of combustible material, such as lint, dust or greasy vapors. Such occupancies are banks, offices, churches, hotels and institutions (but not kitchens, service rooms and manufacturing portions).

(2) The return openings are at least 7 feet above the floor or are protected by corrosion-resistant metal screens of at least 14 mesh installed back of the grilles so that they will not draw in papers, refuse, cigarettes and other combustible solids.

(3) The minimum design velocity in the return from the particular occupancy is 1,000 feet per minute.

(b) Clean-out openings at approximately 20-foot intervals shall be provided where accessibility to facilitate cleaning is required and where the ducts are smaller than 18 x 24-inch. Re-

movable grilles of adequate size and accessibility may be accepted as clean-out openings.

(c) Supply ducts, other than vertical, shall conform to the above regulation for return ducts, unless all of the supply air passes through either water spray or filters.

13.4. Installation of ducts.

(a) Ducts shall not be built into a building in such a way as to impair the effectiveness of the fireproofing around steel or iron structural members, such as placing ducts between the fireproofing and the members protected, except in the case of beams or joists protected by a fire-resisting ceiling.

(b) Where the installation of ducts in walls, floors, or partitions requires the removal of any firestopping, the spaces around the duct at such points where firestopping was removed shall be tightly filled with asbestos, mineral wool or other noncombustible material.

(c) Ducts which pass through floors of fire-resistive construction, protected noncombustible construction, or heavy timber construction, and in which vertical openings are protected shall be encased in 4-inch hollow clay tile, 4-inch gypsum block, or their equivalent except as qualified below:

(1) The encasing of ducts shall not be required for branches which are cut off from the main portion of the duct by approved fire dampers.

(2) Ducts which are located in one story and have all duct openings extending through a floor to the story next above or below may in lieu of such fire-resistive enclosure be provided with approved fire dampers at each such point where the floor is pierced.

(3) Two or more ducts serving separate floors shall not be encased in the same fire-resistive enclosure unless approved automatic fire dampers are installed where each branch is taken from such encased ducts.

(d) Public exit halls in institutional occupancies and in hotels and multifamily houses shall not be used as plenums, that is, as compartments to which one or more ducts are connected so as to form part of the air distribution system.

(e) Ducts shall be substantially supported. Hangers and brackets for supporting ducts shall be of metal.

13.5. Clearances from warm air ducts.

(a) Metal warm air ducts shall be installed with clearances to combustible material as follows:

(1) Within a distance of 3 feet of the plenum of a system classified under Items I and III of Table 2.3(a), the clearance shall be not less than specified above the bonnet or plenum.

(2) Within a distance of 6 feet of the plenum of a system classified under Items II, IV and VI of Table 2.3(a), the clearance shall be not less than specified above the bonnet or plenum.

(3) Beyond the distance from the plenum specified in paragraph 13.5(a) and (b), the clearance shall be not less than $\frac{1}{2}$ inch except as provided in paragraphs 13.5(a) (4) and (5).

(4) From ducts of furnaces classified under Item IV of Table 2.3(a), the clearance shall be not less than 6 inches out to 6 feet and one inch beyond 6 feet to a point where there is a change in direction equivalent to 90 degrees or more.

(5) From ducts of furnaces that require 18-inch clearance above the bonnet or plenum (see Table 2.3(a)) the clearance shall be not less than 18 inches out to 3 feet, not less than 6 inches from 3 feet to 6 feet, and not less than one inch from 6 feet to 12 feet.

(b) Where a metal warm duct passes through or pierces a partition or enclosure constructed of combustible material, the ends of the space providing the required clearance may be closed with a thimble and collar or the wall surfaces extended to the duct with noncombustible building materials such as plaster on metal lath.

13.6. Automatic fire doors and dampers.

(a) When ducts or the outlets from or inlets to them pass through fire walls, they shall be provided with approved automatic fire doors on both sides of the wall through which they pass. On small openings not exceeding 18 inches in diameter, $\frac{3}{8}$ -inch steel plates may be used as fire doors. Suitable hand hole openings shall be provided to make all fire doors and fire dampers in ducts accessible for inspection and servicing.

(b) An approved fire damper shall be provided on each opening through a required two-hour partition.

(c) In a system having a total fan capacity in excess of 3,000 cubic feet per minute, each main duct which serves more than one floor shall be provided with an approved fire damper at the floor or ceiling level of each floor served, or at each direct opening in such main duct and in each branch at its junction with the main duct.

(d) Aluminum ducts which pass through floors of fire-resistive construction, unless encased as specified in section 13.4(c), shall have approved fire dampers at the floors.

(e) Dampers in systems used solely for exhaust of air to the outside shall be installed in the branches so as not to interfere with the outward flow of air in the main duct. Where direction of exhaust air flow is upward, subducts at least 22 inches in length may be carried up inside the main duct from each inlet, in lieu of dampers.

13.7. Fresh air intakes.

(a) Fresh air intakes shall be protected against exterior fire exposure by approved fire doors, dampers or other suitable protection in accordance with the degree of exposure hazard.

(b) Fresh air intakes shall be protected by screens of corrosion resistant material not larger than one-half inch mesh.

13.8. Air inlet and outlet openings.

(a) In a system having a total fan capacity in excess of 3,000 cubic feet per minute, discharge and exhaust air openings and recirculating air intakes shall be located at least 3 inches above the floor, except that floor openings may be permitted under seats in places of assembly having fixed seats.

(b) When located less than 7 feet above the floor, inlet and outlet openings shall be protected by a substantial grille or screen that has openings through which a half-inch sphere will not pass.

13.9. Air filters.

(a) Air filters shall be of approved types that will not burn freely or emit large volume of smoke or other objectionable products of combustion when attacked by flames.

(b) Liquid adhesive coatings used on air filters shall have a flashpoint not lower than 325 F., Cleveland open cup tester.

13.10. Controls.

(a) Each installation shall be equipped with a manual emergency stop control, located at a conveniently accessible point, for quick shutting down of the fan in case of fire.

(b) In systems utilizing recirculation, serving more than one story of a building, or more than one fire section of a single story, fans shall be arranged to shut down automatically when the temperature of the air in the system becomes excessive, as from a fire. For this purpose an approved thermostatic device with a setting not in excess of 125 F. shall be located in the system at a suitable point in the return air duct ahead of the fresh air intake. Either the thermostatic device shall be of a type that is manually reset or the control system shall be so arranged that some manual operation is required to restart the fan after the thermostat has operated.

13.11. Air cooling equipment.

Mechanical refrigeration used with air duct systems shall be installed in accordance with nationally recognized safe practices. Installations conforming to the American Standard Safety Code for Mechanical Refrigeration, ASA-B9.1, shall be considered as meeting these requirements.

SECTION 14. DOMESTIC TYPE INCINERATORS.**14.1. Application.**

This section applies to direct-fed incinerators having a firebox or charging compartment of not over 5 cubic feet in capacity when used in dwellings and in other occupancies where the character and amount of refuse burned is not excessive as compared to a dwelling.

14.2. Gas burner connections.

Where a gas burner is used, a shut-off cock shall be provided at an accessible location in the gas line to the burner. Incinerators for use with liquefied petroleum gas and those furnished with means

for automatic ignition of the gas at the main burner shall be equipped with a device which will automatically shut off the main gas supply in the event the means of ignition becomes inoperative, or the means of keeping the valve of the device open becomes inoperative, or both. Where liquefied petroleum gas is used, the arrangement shall be such as to shut off the gas supply to the pilot burner also.

14.3. Mounting.

(a) Domestic type incinerators, except as provided in paragraphs 14.3(b) and (c), shall be mounted on the ground or on floors of fire-resistive construction with noncombustible flooring or surface finish and with no combustible material against the underside thereof, or on fire-resistive slabs or arches having no combustible material against the underside thereof. Such construction shall extend not less than 12 inches beyond the incinerator base on all sides, except that at the front or side where ashes are removed, it shall extend not less than 18 inches beyond the incinerator.

(b) Domestic type incinerators that are specifically approved for installation on a combustible floor may be mounted in accordance with the conditions of such approval.

(c) Domestic type incinerators which are set on legs that provide not less than 4 inches open space under the base of the incinerator may be mounted on floors other than as specified in paragraph 14.3(a), provided the incinerator is so arranged that flame or hot gases do not come in contact with its base, and further provided the floor under the incinerator is protected with hollow masonry not less than 4 inches thick covered with sheet metal of not less than 24 gauge. Such masonry course shall be laid with ends unsealed and joints matched in such a way as to provide a free circulation of air from side to side through the masonry. The floor for 18 inches beyond the front of the incinerator or side where ashes are removed and 12 inches beyond all other sides of the incinerator shall be protected with asbestos mill-board not less than $\frac{1}{4}$ of an inch thick covered with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

14.4. Clearances.

(a) Domestic type incinerators, except as provided in paragraphs 14.4(b) and (c), shall be installed to provide clearances between the unit and woodwork or other combustible material, of not less than 36 inches at the sides and top and not less than 48 inches at the front but in no case shall the clearance above the charging door be less than 48 inches.

(b) Domestic type incinerators that are specifically approved for installation with clearances less than specified in paragraph 14.4(a) may be installed in accordance with the conditions of such approval, provided that in any case, the clearances shall be sufficient to afford ready accessibility for firing, clean-out and any necessary servicing, and with a minimum clearance of 3 inches between the sides and combustible material.

(c) Domestic type incinerators may be installed in rooms, but not in confined spaces such as alcoves, with reduced clearances to woodwork or other combustible material, provided the combustible material is protected as described in Table 2.3(b), but in no case shall this clearance be less than 3 inches to the protection.

(d) When a domestic type incinerator that is refractory lined or insulated with heat-insulating material is encased in common brick not less than 4 inches in thickness, the clearances may be reduced to 6 inches at the sides and rear, and the clearance at the top may be reduced to 24 inches provided that the construction using combustible material above the charging door and within 48 inches is protected with 28 gauge sheet metal spaced out 1 inch, or equivalent protection.

14.5. Chimney.

Domestic type incinerators shall be connected to a chimney suitable for solid fuel burning appliances.

14.6. Flue pipes.

(a) Domestic type incinerator flue pipes, except as provided in paragraph 14.6(b), shall be installed to provide clearance of not less than 18 inches to woodwork or other combustible material.

(b) Domestic type incinerator flue pipes may be installed in rooms, but not in confined spaces such as alcoves, with reduced clearances to woodwork or other combustible material provided the combustible material is protected as described in Table 2.3(b).

(c) Domestic type incinerator flue pipes shall not pass through any combustible wall or partition unless protected at the point of passage in accordance with paragraph 9.2(g).

14.7. Refuse chutes.

Refuse chutes shall not feed directly into incinerators.

SECTION 15. FLUE-FED INCINERATORS. (APARTMENT HOUSE TYPE)

15.1. Application.

This section applies to incinerators having a combined refuse chute and smoke flue with provisions for feeding waste materials directly into the combustion chamber from one or more floors above the incinerator.

15.2. Provisions for auxiliary fuel.

Where a gas burner is used, a shut-off cock shall be provided at an accessible location in the gas line to the burner. Incinerators for use with liquefied petroleum gas, those having an input of more than 50,000 Btu per hour and those furnished with means for automatic ignition of the gas at the main burner shall be equipped with a device which will automatically shut off the main gas supply in the event the means of ignition becomes inoperative, or the means of keeping the valve of the device open becomes inop-

erative, or both. Where liquefied petroleum gas is used, the arrangement shall be such as to shut off the gas supply to the pilot burner also.

15.3. Combustion chambers.

(a) Enclosing walls of combustion chambers having a horizontal combined hearth and grate area of 7 square feet or less shall be constructed of clay or shale brickwork not less than 4 inches thick with a lining of fire brick not less than $4\frac{1}{2}$ inches thick, or of construction equivalent thereto.

(b) Enclosing walls of combustion chambers having a horizontal combined hearth and grate area exceeding 7 square feet shall be constructed of clay or shale brickwork not less than 8 inches thick and $4\frac{1}{2}$ inches of fire brick as a lining with a space between the clay or shale brickwork and the fire brick lining sufficient to provide for expansion and contraction, or of construction equivalent thereto.

(c) Fire brick shall be laid in high temperature cement or fire clay mortar. All common brickwork shall be laid with full, push filled, cross and bed mortar joints.

(d) No metal stays, lintels not part of a door frame casting, or other supports shall be exposed to the interior of the furnace or the products of combustion where auxiliary fuel is provided or where the incinerator is designed for operation at or above 1,000 F.

15.4. Combined refuse chute and flue.

The chimney of a flue-fed incinerator shall be constructed in accordance with nationally recognized good practice. Construction in accordance with Article X of the National Building Code recommended by the National Board of Fire Underwriters shall be considered as in accordance with nationally recognized good practice.

15.5. Service openings to incinerators.

(a) The daylight area of each service opening shall be limited to one-third of the cross-sectional area of the flue, except that in one family dwellings, the service opening may be one-half the cross-sectional area of the flue. Where the flue area exceeds 22 by 22 inches, no service opening shall be used that has an area in excess of 160 square inches.

(b) All service openings into an incinerator flue shall be provided with a hopper or other charging device constructed of metal of sufficient thickness and durability to prevent cracking, breakage or deformation in normal use. Such hopper or other charging device shall be firmly built into the masonry and shall be so designed and installed that no part will project into the flue and that the opening to the flue interior will be closed off while the service opening (hopper) door is fully open. The hopper or other device shall be counterweighted or otherwise devised so that it will close automatically upon release and be so constructed as to be tightly fitted when in the closed position.

(c) No service opening shall be installed in any part of the combustion zone of an incinerator.

15.6. Mounting.

Flue-fed incinerators shall be set on proper foundations on the ground or on fire-resistive floors with no combustible material on the underside thereof.

15.7. Incinerator rooms.

(a) Incinerators in which the combined hearth and grate area of the combustion chamber exceeds 7 square feet shall be enclosed within a room separated from other parts of the building by walls, and floor and ceiling assemblies having a fire resistance rating of not less than 2 hours.

(b) Door or other openings in rooms containing incinerators communicating with other areas of the building shall be protected by approved self-closing or automatic fire doors suitable for Class B situations.

(c) Ducts extending from an incinerator room through other parts of a building shall be constructed and protected in accordance with section 13.

15.8. Spark arresters, expansion chambers.

All flues shall terminate in a substantially constructed spark arrester with openings not greater than $\frac{1}{2}$ of an inch, or be provided with other suitable means for avoiding discharge of fly particles. Expansion chambers used as a secondary combustion chamber shall be constructed equivalent to that of the incinerator combustion chamber, section 15.3. Expansion chambers that are used only for settling shall be of construction equivalent to that of the upper portion of incinerator flue, and a clearance of not less than 2 inches from the chamber to combustible construction shall be provided. Expansion chambers shall be provided with substantial noncombustible supports. Every expansion chamber shall have a vent of cross-sectional area at least equal to that of the flue.

SECTION 16. COMMERCIAL AND INDUSTRIAL TYPE INCINERATORS.**16.1. Application.**

This section applies to incinerators other than outdoor waste or trash burners and those covered in sections 14 and 15.

16.2. Provisions for auxiliary fuel.

Where a gas burner is used, a shut-off cock shall be provided at an accessible location in the gas line to the burner. Incinerators for use with liquefied petroleum gas, those having an input of more than 50,000 Btu per hour and those furnished with means for automatic ignition of the gas at the main burner shall be equipped with a device which will automatically shut off the main gas supply in the event the means of ignition becomes inoperative, or the means of keeping the valve of the device open becomes inoperative, or both. Where liquefied petroleum gas is used the arrangement shall be such as to shut off the gas supply to the pilot burner also.

16.3. Combustion chambers.

(a) Incinerators shall have the enclosing walls of combustion chambers constructed of clay or shale brick not less than 8 inches thick with a lining of fire brick not less than $4\frac{1}{2}$ inches thick, or of construction equivalent in structural strength, in insulating value and in ability to withstand thermal expansion and flame impingement. Provision shall be made for expansion and contraction of fire brick.

(b) Enclosing walls of incinerators shall be strongly braced and stayed with structural steel shapes designed to withstand interior thrusts and support door and appurtenant assemblies, except that intermittent duty incinerators not over 85 cubic feet in capacity and burning not over 165 pounds per hour need not have a steel frame if otherwise constructed to conform to paragraph 16.3(a).

(c) Fire brick shall be laid in high temperature cement or fire clay mortar. All common brickwork shall be laid with full, push-filled, cross and bed mortar joints.

(d) No metal stays, lintels or other supports shall be exposed to the interior of the combustion area.

16.4. Incinerator rooms.

(a) Incinerators in which the combined hearth and grate area of the combustion chamber exceeds 7 square feet shall be enclosed within a room separated from other parts of the building by walls, and floor and ceiling assemblies having a fire resistance rating of not less than two hours, with floor of earth or other noncombustible material. Openings to such rooms shall be protected by approved self-closing or automatic fire doors suitable for Class B situations.

(b) Ducts extending from an incinerator room through other parts of a building shall be constructed and protected in accordance with section 13.

16.5. Refuse chutes, terminal rooms or bins.

(a) Rubbish or refuse chutes other than charging chutes shall rest upon substantial noncombustible foundations. Enclosing walls of such chutes shall consist of clay or shale brickwork not less than 8 inches thick or of reinforced concrete not less than 6 inches thick. Such chutes shall extend at least 4 feet above the roof and be covered by a metal skylight glazed with thin plain glass.

(b) Rubbish or refuse chutes shall terminate or discharge directly into a room or bin separated from the incinerator room and from other parts of the building by walls and floor and ceiling assemblies having a fire resistance rating equal to that specified for the chute. Openings to such rooms or bins shall be protected by approved self-closing or automatic fire doors suitable for Class B situations.

(c) Each service opening in a rubbish or refuse chute shall be protected by an approved self-closing fire door suitable for Class B situations or an approved chute door. Every such service opening shall be enclosed in a room or compartment separated from other parts of the building by walls and floor and ceiling assemblies

having a fire resistance rating of not less than one hour with openings to such a room or compartment protected by approved fire doors suitable for Class B situations.

16.6. Charging chutes and enclosures.

(a) Where the combustion chamber of an incinerator is charged through the floor above such incinerator, the charging chute shall be constructed of not less than 12 gauge steel casing, lined with not less than $4\frac{1}{2}$ inches of fire brick or equivalent refractory. Such charging chute shall not exceed 6 feet in length measured from the floor opening to the outside of the roof of the incinerator combustion chamber, unless approved means are provided to prevent the charging chute from discharging gases resulting from combustion into the charging room. When a top charging extension is provided, it shall be lined with refractory material not less than $4\frac{1}{2}$ inches thick. The charging chute opening shall be protected by a cover extending beyond the edges of the opening for at least 2 inches on all sides, and lined with not less than $2\frac{1}{2}$ inches of refractory material.

(b) Charging chute floor openings shall be located in a room with walls and floor and ceiling assemblies having a fire resistance rating of not less than two hours and with openings protected by approved self-closing or automatic fire doors suitable for Class A situations, except that where the room is protected by an approved system of automatic sprinklers, the walls and floor and ceiling assemblies may have a fire resistance rating of not less than one hour and the door may be one approved for Class B situations.

16.7. Flue pipes.

(1) The flue pipes or breechings connecting incinerators to chimneys or flues, except as provided in paragraph 16.7(b), shall be constructed of not lighter than 16 gauge steel when they are 12 inches or less in diameter or greatest dimension and of not lighter than 12 gauge steel when they exceed 12 inches in diameter or greatest dimension. In addition, they shall be lined with fire brick not less than $2\frac{1}{4}$ inches thick, laid in high temperature cement or fire clay mortar when they are more than 12 inches but not in excess of 18 inches in diameter or greatest dimension, and with fire brick not less than $4\frac{1}{4}$ inches thick when they are over 18 inches in diameter or greatest dimension.

(b) Flue pipes of incinerators specially constructed to produce low flue gas temperatures, and incinerator flue pipes not over 10 inches in diameter and not over 8 feet long may be of flue tile properly supported and insulated, or of other suitable construction without fire brick lining where located entirely within the incinerator room.

(c) Where incinerator flue pipes or breechings lead into and combine with flue pipes or breechings of other appliances such other flue pipes shall also be lined from this point to the chimney as specified in paragraph 16.7(a) for incinerator flue connections, except that lining of this portion may be omitted where the cross-sectional area of such other flue pipe is at least equal to the area

of the incinerator flue pipe or breeching and the combined breeching is large enough for full load conditions of both services and will carry flue gases at a temperature not higher than 900 F.

(d) Clearance between incinerator flue pipes or breechings and combustible construction, including plastered constructions having combustible supports, shall be not less than 36 inches.

16.8. Chimneys.

Chimneys for commercial and industrial type incinerators shall be constructed in accordance with nationally recognized good practice. Construction in accordance with Article X of the National Building Code recommended by the National Board of Fire Underwriters shall be considered as in accordance with nationally recognized good practice.

16.9. Expansion chambers and spark arresters.

Incinerators used for the burning of rubbish or other readily combustible solid waste material shall include effective means for arresting sparks and fly particles, such as an expansion chamber, baffle walls, or other effective arrangement, or the flues or stacks of such incinerators shall be provided with an approved spark arrester having openings not greater than $\frac{3}{4}$ of an inch.

SECTION 17. BLOWER AND EXHAUST SYSTEMS FOR DUST, STOCK AND VAPORS.

17.1. General.

(a) Blower and exhaust systems for dust, stock or vapors hereafter installed as part of or attached to parts of a building shall be constructed and installed to conform to the requirements of this section.

(b) Blower and exhaust systems heretofore installed as part of or attached to parts of a building shall not be altered, extended or enlarged, except in conformity with the requirements of this section.

17.2. Ducts.

(a) Ducts of blower and exhaust system shall be constructed of noncombustible materials.

(b) Metal ducts shall be constructed of steel or iron not thinner than specified in the following table:

Diameter of duct, inches	U. S. Gauge	
	Non-Abrasive Materials	Abrasive Dusts
Up to 8, inclusive	24	20
Over 8 to 18, inclusive	22	18
Over 18 to 30, inclusive	20	16
Over 30	18	14

(c) Changes in the size of ducts shall be made on a taper.

(d) Ducts shall be tight throughout and no openings shall be permitted except those necessary to perform the required functions of the system.

(e) Ducts shall be substantially supported. Hangers and brackets shall be of metal.

(f) Ducts carrying flammable vapors or dusts shall have a clearance of not less than 6 inches to combustible material. Ducts operating at elevated temperatures shall have clearances to combustible material in accordance with the following table:

Duct Gas Temperature	Largest Duct Dimension	Clearance
Up to 600° F., incl.	8 in.	8 in.
	Over 8 in.	12 in.
Over 600°-900° F., incl.	8 in.	18 in.
	Over 8 in.	24 in.
Over 900° F.	All ducts lined with refractories	24 in.

(g) Ducts shall not pass through fire walls unless unavoidable. When ducts or the outlets from or inlets to same pass through fire walls they shall be provided with approved automatic fire doors or shutters, on both sides of the wall.

(h) Where ducts pass through walls, floors or partitions the space around the ducts shall be sealed with rope asbestos, mineral wool or other noncombustible material to prevent passage of flame and smoke.

17.3. Fans.

(a) Fans shall be so located and installed as to be readily accessible for repairing, cleaning, inspecting and lubricating.

(b) Fans shall not be located in fire walls, or required two-hour partitions.

(c) When flammable materials or vapors are to pass through fans the rotating element shall be of non-sparking material or the casing shall consist of or be lined with such material.

17.4. Grounding.

All metal parts of apparatus, used in systems for the removal of flammable gases or vapors, or systems used for conveying flammable dust, stock or refuse, and shafting in connection therewith, shall be electrically grounded in an effective and approved manner.

17.5. Systems for removal of flammable vapors.

(a) In exhaust systems for the removal of flammable vapors, ducts shall lead to the outside of the building in the most direct manner possible.

(b) Outlets to atmosphere shall be kept clear of and away from combustible materials.

17.6. Dust, stock and refuse conveying systems.

(a) Separating or collecting equipment shall be constructed of or be enclosed by steel or other approved noncombustible material. Supports shall be of steel, masonry or concrete.

(b) Dust collecting systems from grinding and other machines which may produce sparks shall not be combined with collecting systems handling linty or other readily flammable dusts.

(c) Discharge ducts of separating and collecting equipment shall have clearances as specified for ducts in section 17.2.

(d) Storage bins or other receptacles which contain materials which form an explosive mixture with air shall be provided with adequate explosion relief vents.

(e) Explosion relief vents on duct systems shall have a cross-sectional area not less than that of the duct vented, and shall lead to the outside of the building. Explosion relief vent openings shall be provided with rupture diaphragms fitted with cutters to accelerate rupture, or equivalent means of relieving pressure.

(f) Explosion relief vents shall not be connected to chimneys or duct systems used for other purposes.

SECTION 18. HEATING AND VENTILATING EQUIPMENT IN HAZARDOUS OCCUPANCIES.

Heating and ventilating equipment in occupancies involving fire hazards from flammable vapors or dusts, or readily combustible fibers or other highly combustible substances shall be so installed and protected as to be safeguarded against fire and explosion hazards in accordance with nationally recognized safe practice. Compliance with applicable standards of the National Board of Fire Underwriters shall be considered as compliance with nationally recognized safe practice.

SUPPLEMENTARY INFORMATION.

Listed Appliances.

With respect to heating appliances to be considered as "approved specifically for installation on a floor constructed of combustible material," or "in floors constructed of combustible material" or "in walls partitions, floors or ceilings constructed of combustible material," or as "approved specifically for installation with lesser clearances than specified," it is suggested that the building official accept the published listings of any nationally recognized testing agency which is qualified and equipped for experimental testing, and which maintains at least an annual inspection program on current production of listed models, and which makes available a published record of such listings in which specific information is included regarding such mounting or clearances.

Listings of gas and oil burning warm air furnaces, oil burning floor furnaces, and oil burning stoves and ranges, conforming to the above conditions are contained in the "Gas and Oil Equipment List" of Underwriters' Laboratories, Inc. Gas burning appliances are listed under the heading Gas-Heating Appliances, oil burning appliances under Oil-Fired Units except oil burning stoves, ranges and room heaters are listed under the heading Oil-Burning Stoves.

Listings of electric ranges conforming to the above conditions are contained in the "List of Inspected Electrical Equipment" of Underwriters' Laboratories, Inc., under the heading Heaters—Ranges. Listings of electric heating furnaces will be found in the same list under the heading Heaters—Furnaces, Electric Central Heating, and radiant heating equipment under the heading Heaters—Radiant Heating Equipment.

Listings of various kinds of gas burning appliances conforming to the above conditions are contained in the "Directory" of approved gas burning appliances of the American Gas Association Laboratories, 1032 East 62nd St., Cleveland 3, Ohio. These listings include central heating boilers and furnaces, domestic ranges, hotel and restaurant ranges, room heaters, unit heaters, and water heaters. Domestic gas ranges are approved for installation with clearances in accordance with the following table:

Type of Range	Spacing of Top Burner Opening from Side of Range	Distance from Combustible Construction—Inches			
		Sides		Rear	
		Wall Not Extending Above Cooking Top	Wall Extending Above Cooking Top	Body of Range	Projecting Flue Box
Uninsulated	—	6	6	6	1
Insulated*	Less than 5 in.	$\frac{1}{2}$	3	1	1
Insulated	5 in. or more	$\frac{1}{2}$	$\frac{1}{2}$	1	1
Flush to Wall	Less than 5 in.	Flush	3	Flush	—
Flush to Wall	5 in. or more	Flush	Flush	Flush	—

* Approved as insulated models in accordance with American Standard Approval Requirements for Domestic Gas Ranges Z21.1.

Note.—The latest lists should be consulted in each case. Later editions of the lists of Underwriters' Laboratories, Inc., and of the American Gas Association Laboratories may contain listings conforming to the stated conditions, of other types of heating appliances.

High Pressure Steam and Hot Oil Pipes.

High pressure steam pipes, hot oil pipes, etc., unless suitably insulated, may need greater clearance than one inch as required by section 11, depending on the temperature and diameter of the pipe.

Flameproofed Fabric.

For information on approved flameproofed fabric for flexible duct connectors as specified in section 13.2(d), see "Fire Protection Equipment List" of Underwriters' Laboratories, Inc., under the heading Fabrics—Flame Retarded.

APPENDIX J.

Earthquake Resisting Construction.

Earthquakes are of more frequent occurrence than is generally supposed. The historical record indicates that practically no part of the United States has been entirely free from such disturbances. Experience shows that in those areas which have been visited by major earthquakes, a recurrence is more than likely, though the intervals between visitations may be a number of years. In these latter regions it is desirable that suitable provisions be incorporated in the building code to safeguard buildings against the destructive force of these physical occurrences.

The prime requisites in the construction of earthquake-resistant buildings are strength, rigidity and workmanship. In buildings of the reinforced concrete or steel frame type adequate bracing, to take up the lateral forces, must be provided. Masonry walls and interior partitions should preferably be a type that is reinforced, with the reinforcing steel, in reinforced concrete or steel frame construction, carried around the vertical members. It is most important that foundations be continuous under the entire structure, or when that is not practicable, that at least all footings be interconnected. So far as location, shape and height can be controlled by statute, provisions might be made advantageously to require buildings to stand apart; to be as nearly as possible square in plan and to avoid U-shaped or L-shaped outlines; to diminish in area as their height increases.

Experiences in earthquake areas justify the following provisions. They may be properly incorporated in Article IX of the National Building Code.

There is no reason to exclude any building or structure. The small one- and two-story commercial building has always been one of the worst offenders in past shocks. In the Long Beach, California area in 1933, over 700 small dwellings, mostly one-story, were thrown off their foundations. Dozens of dwellings were similarly affected in the Imperial Valley in 1940.

The design of small or minor wood structures to resist shock is a simple problem, so there is no valid excuse for excluding any such structures from having to comply with this section.

Thousands of buildings and structures, both large and small, have been designed and constructed to resist lateral forces of 8 per cent or more. The Southern California Edison Co. building, the Alameda County Court House, and the Hoover Library at Stanford University are examples of fire-resistive buildings 150 feet high or over designed for lateral forces of 10 per cent.

The following are suggested sections to be incorporated in the National Building Code:

902.11. Resistance to earthquakes.

(a) General.

All buildings and structures, and every portion thereof, shall be designed and constructed to resist the horizontal forces pro-

duced by earthquakes in accordance with the requirements of this section in addition to all other loads required by the provisions of this code.

(b) Horizontal forces to be resisted.

(1) Stresses shall be calculated as the effect of a force applied horizontally at each floor and roof level above the foundation, such force to be calculated in accordance with the requirements of this section. The force shall be assumed to act along the major axes of the building or at right angles to any elevation of the building. In special structures, such as towers, application in a diagonal direction may be required.

(2) The horizontal force to be resisted shall be determined as follows: $F = CW$

Where "F" equals the horizontal force in pounds, "W" equals the total dead load plus 25 per cent of the live load prescribed by this code at and above the plane or elevation under consideration except for buildings one story in height and warehouses and similarly loaded buildings where "W" shall equal the total dead load plus 50 per cent of the total live load prescribed by this code at and above the plane or elevation under consideration. In no case shall the live load on the roof of a one-story building be assumed as less than twelve pounds per square foot. All fixed, permanent contents, such as machinery, desks, etc., shall be considered part of the dead load. "C" equals a numerical constant and shall be as specified in the following table:

Building or Structure and Part or Portion Thereof	Value of "C"	Direction of Force
1. The building or structure as a whole..	.10	as specified above in 902.11(b) (1)
2. Bearing walls, enclosure walls, 2-hour partitions, panel walls .....	.20	normal to surface of wall
3. Fire wall, parapet wall, cantilever parapet and cantilever walls	1.00	normal to surface of wall
4. Exterior and interior ornamentations and appendages, handrails, marquises	1.00	a horizontal direction
5. Chimneys, smokestacks, flag poles, penthouses .....	.20	a horizontal direction
6. Tanks, towers, tanks and towers, plus contents; supported directly on the ground, and clear of buildings .....	.10	as specified above in 902.11(b) (1), or in a diagonal direction when required.
7. Tanks, towers, tanks and towers, plus contents; when located on or over a building .....	.20	as specified above in 902.11(b) (1), or in a diagonal direction when required.

Where the building or structure is so located that the soil at the site cannot safely carry the superimposed loads involved, making necessary the use of piles, caissons, etc., the values of "C" in items 1, 2, 5 and 6 shall be increased 25 per cent

(c) Stresses.

Stresses in materials shall not exceed those specified in this code by more than 25 per cent provided that rivets may be stressed in tension to the same value as allowed in single shear; and that shear in reinforced concrete walls, piers, and pilasters used for bracing purposes shall not exceed 4 per cent of the ultimate strength in compression at 28 days with a maximum of 120 pounds per square inch; and that shear in reinforced brick walls, columns and pilasters used for bracing purposes shall not exceed 60 pounds per square inch; and that the unit stress in reinforcing steel shall in no case exceed 24,000 pounds per square inch; and that axial compression or extreme fibre stress in compression in concrete shall in no case exceed 40 per cent of the ultimate compressive strength at 28 days with a maximum of 1,200 pounds per square inch.

(d) Design, bonding and tying.

(1) All parts of buildings and structures shall be so bonded and tied together that the entire assembly shall act as a unit.

(2) Floors and roof shall be designed of sufficient strength and rigidity to transmit the horizontal forces to the several vertical resisting bents or elements in proportion to their relative rigidities or stiffness.

(3) Veneers, facings, cornices, and ornamental details shall be bonded to the structure to form an integral part of it. This applies to the interior as well as the exterior of the building.

(4) Buildings and structures shall not be placed in close contact with other buildings and structures. Minimum separation shall be three inches for a height of building or structure up to fifty feet; four inches, from fifty-one feet to seventy-five feet; five inches, from seventy-six feet to one hundred feet, and six inches or more for heights over one hundred one feet.

(5) Junctures between the main portion of a building or structure and any outstanding distinct parts such as wings shall be designed for rotational forces unless the design is such that rotational forces will be prevented.

(e) Foundations.

(1) Where practicable, foundation walls and footings shall be continuous under the entire building or structure.

(2) The footings of all buildings and structures resting on piles or caissons or on ground capable of withstanding safely a vertical load not greater than two tons per square foot shall be completely interconnected by members of reinforced concrete or steel encased in concrete. Such interconnection shall be capable of withstanding in either tension or compression 10 per cent of the vertical load including the total live load, supported by the more heavily loaded of the footings interconnected; except that if a

footing with a light load depends solely on a more heavily loaded footing for interconnection in one direction only, the load on this (lightest load) footing may be used in figuring the required size of interconnections.

APPENDIX K.

Windstorm Resisting Construction.

The National Building Code gives minimum requirements applicable to moderate wind conditions. This appendix contains supplemental provisions for resistance to more severe wind conditions, which are in accord with good engineering practice, and which are prepared in the form of amendments to the Code.

Alternate provisions are included on three items so that the provisions may, by selection of the proper alternate, be used for either the severe wind conditions such as occur from direct hits of hurricanes of maximum intensity or for other areas subject to somewhat less severe wind conditions such as those that accompany hurricanes and other types of windstorms.

The items for which alternate provisions are given are design wind loads (section 903.1), signs and outdoor display structures (section 903.7), and lateral support of masonry walls (section 909.14).

The more severe requirements of each set of alternate provisions are recommended for use within 50 miles of the Gulf Coast and of the Atlantic Coast from the southernmost part of Florida up to Chesapeake Bay. The less severe requirements are recommended for use in all other areas subject to moderately severe windstorms.

The degree of protection against damage from windstorms provided by compliance with this appendix cannot be assured for tornadoes but compliance with either set of alternate requirements would be helpful to some extent in reducing tornado damage.

Information regarding windstorms may be obtained from a pamphlet, *Windstorm Damage Prevention*, a publication of the National Board of Fire Underwriters.

Amend section 706.6 to read:

706.6. Roof anchorage.

Every roof girder and every roof beam shall be anchored to an exterior or interior wall or to a properly designed interior column. Wall beams and plates shall be anchored to the wall with approved type anchors not more than 4 feet apart. Roof planking where supported by a wall shall be anchored to such wall at intervals not exceeding 4 feet. Roof trusses shall be securely anchored to masonry walls at points of bearing. Monitor and saw tooth construction shall be anchored to the main roof construction. Anchors shall consist of steel or iron bolts or straps of sufficient strength and ample anchorage to resist vertical uplift of the roof as required in section 903.3.

Replace section 707.4 with the following:

707.4. Anchorage.

(a) All trimmers and at least one beam or joist in every 4 feet resting on masonry walls, shall be secured to such walls by approved metal anchors attached at or near the bottom in a manner to be self-releasing. Each end of a trimmer, beam or joist that is supported by a girder shall be secured or tied in an approved manner to such girder or to a trimmer, beam or joist correspondingly supported from the opposite side of such girder. Anchors and ties shall be so arranged as to form continuous ties between opposite masonry walls.

(b) Where floor or roof joists or beams run parallel to masonry walls, such walls shall be secured to 4 or more joists of the floor or roof construction by approved metal anchors at maximum intervals of 8 feet for dwellings, and 6 feet in other buildings.

(c) Wall plates and roof construction shall be anchored to the walls at least every 6 feet, except that wall plates and roof construction shall be anchored at intervals of 4 feet to hollow concrete masonry walls which do not have cast-in-place reinforced concrete tie beams.

(d) Wooden girders shall be anchored to the walls and fastened to each other with suitable steel straps placed near the bottom of the girder.

(e) At least every third rafter shall be anchored to the ceiling joists or partitions directly beneath by not less than the equivalent of 1- x 6-inch boards securely nailed. Such braces shall be attached to the rafters at their mid points or at the third points if two are used per rafter. In peaked roofs opposite rafters shall be laterally braced to each other at the ridge in a manner satisfactory to the building official.

(f) Roof trusses shall be securely anchored to masonry walls at points of bearing.

(g) Anchors shall consist of steel or iron bolts or straps of sufficient strength and ample anchorage to resist vertical uplift of the roof as required in section 903.3.

Insert new paragraph in section 707.6 as follows:

(d) Where wood stud partitions and masonry walls join, the stud abutting the masonry shall be doubled and bolted to the masonry with three ½-inch galvanized bolts, one to be embedded in the tie beam, one in mid-section, and one near the base. The end of the partition plate shall also be anchored to the stud abutting the wall and to the wall plate in an approved manner.

Replace paragraph 708.4(b) with the following:

(b) Rafters shall be anchored to the wall plate by approved metal anchors attached to at least every other rafter or shall be otherwise anchored in an approved manner.

Insert new paragraphs in section 708.4 as follows:

(d) Girders resting on masonry foundation walls or piers shall be anchored thereto with not less than ½-inch bolts embedded at least 6 inches in the masonry.

(e) Wooden columns and posts shall be securely anchored to their foundations and to the members which they support.

(f) At least every third rafter shall be anchored to the ceiling joist or partitions directly beneath by not less than the equivalent of 1- x 6-inch boards securely nailed. Such braces shall be attached to the rafters at their mid-points or at the third points if two are used per rafter.

(g) Each rafter shall be laterally braced to the opposite rafter at a point underneath the ridge, in order to form a brace known as the "A" type or "Collar Beam," except that roof construction of the "Exposed Cathedral Type" or "Exposed Shed Type" may have such bracing omitted when the rafters are securely anchored and braced in an approved manner. Roof framing and trussing of all other types of roof construction shall be anchored by an approved method.

Replace section 802.3 with the following:

802.3. Installation.

(a) General requirements for all roof coverings. Roof coverings shall be securely attached to the roof in accordance with the manufacturer's instructions and specifications and with the methods approved by the building official. Nails, clips and similar attaching devices shall be galvanized or otherwise suitably corrosion resistant.

(b) Prepared shingle roof coverings.

(1) Wood roof decks to which prepared shingles are applied shall be solidly sheathed. Sheathing shall be well seasoned and dry. Sheathing boards shall be at least 1 inch nominal dimension boards not over 6 inches wide. Plywood sheathing shall be at least $\frac{3}{8}$ of an inch thick.

(2) Attic spaces shall be vented with vent openings so placed as to circulate air in all parts of the attic.

(3) Nails shall be of sufficient length to extend through the roof deck (sheathing).

(4) Thick-butt asphalt shingles shall be nailed in the thick portion of the shingle.

(5) All butts or tabs of asphalt shingles shall be securely spotted or tabbed with a plastic, fibrous, asphaltic cement or anchored by clips or locks, and all edges at eaves and gables shall be set in such cement 3 inches back from the edge.

(6) Metal drip edges shall be nailed to the roof deck with nails not less than 10 inches on centers.

(c) Built-up roof coverings.

(1) For built-up roof coverings cant strips shall be provided at the angle of roof and vertical surfaces.

(2) Built-up roof coverings shall be carried at least 6 inches above the cant strip to a reglet in the parapet and covered with metal flashing calked into the reglet. Reglet may be omitted at parapet walls provided two layers of felt or the equivalent are carried across the top of the parapet under coping and down the

parapet to the lower edge of the cant strip. The said layers to run vertically, properly lapped and cemented to the parapet.

(3) All resinous places in the wood roof deck shall be covered with sheathing paper or unsaturated felt.

(4) The first layer or anchor sheet shall be not less than 30-pound felt nailed 6 inches on centers along a 2-inch lap and nailed 12 inches on centers, both ways, in the area between laps with tin caps and 1-inch nails; or shall be not less than two layers of 15-pound felt lapped 19 inches and nailed through both sheets on 6-inch centers along the lap and on 12-inch centers in the area between laps with tin caps and 1-inch nails; or, where the underside of the roof sheathing is to be exposed and its appearance considered, the first layer shall be not less than a 30-pound felt or two layers of 15-pound felt nailed 6 inches on centers along the rafters with tin caps and 1¼-inch nails, and nailed 12 inches on centers, both ways, between rafters, with tin caps and ¾-inch nails.

(5) Each additional sheet above the anchor sheet shall be thoroughly mopped between layers with a bituminous compound so that no layer touches an unmopped layer. Bituminous compound for mopping plys together shall be air refined asphalt or coal tar pitch but shall not be any type of emulsion, cold or cut back liquid cement, oil or grease.

(6) Gravel stop and drip strips, and eave and gable drips shall be not less than 26 gauge galvanized metal, 16 ounce copper or 0.025 inch aluminum, with not less than 3-inch flange on roof and nailed with not less than ¾-inch nails spaced not more than 6 inches apart.

(d) Roll roofing.

(1) Roll roofing shall be applied only over a smooth surface. Roll roofing shall not be applied over shingle roofs.

(2) Roll roofing applied in a single layer shall be spot mopped and applied by concealed nail method with a minimum 3-inch head lap and a minimum 6-inch end lap properly cemented. Nail spacing shall be not less than 4 inches on centers.

(3) Nails that secure roll roofing to the roof deck shall be driven at least ¾ of an inch from the edge of the sheet.

(e) Tile roofing.

(1) Tile roofing shall be laid over not less than one layer of 30-pound asphalt felt securely fastened by nailing with tin caps.

(2) All tile shall be thoroughly watered with a hose before application.

(3) Every tile shall be laid full length in portland cement mortar and in addition the first three horizontal courses shall be nailed. Under certain conditions additional nailing may be required to prevent the tile from slipping. Mortar shall be not less than one part cement and three parts sand and not more than twenty-five per cent lime by volume.

(4) All nails for flashing and tiles shall be copper.

(f) Corrugated metal roofing, protected metal roofing, corrugated and flat sheet asbestos cement roofing.

(1) When roofings of the above types are applied to wood roof decks they shall be secured with drive screws of sufficient length to extend through the roof deck. When applied directly to purlins and other roof members they shall be secured with bolted strap fasteners, bolts or stud fasteners. Properly designed clip fasteners that are approved may be used in accordance with the conditions of such approval. Drive screws at least 4 inches in length may be used to secure these roofings directly to wood purlins.

(2) Aluminum roofing when fastened to steel roof structure shall be insulated against electrogalvanic action.

(g) Insulated steel deck roofing. Insulated steel deck shall be secured by spot welding of clips or spot welding the sheets to the steel purlins, or by equivalent means.

Replace Table in section 903.1 with one of the following depending upon the severity of the wind conditions. See introductory paragraphs.

For areas subject to severe windstorms.

Height Zone (Feet)	Wind Pressure (Lbs. per Sq. Ft.)
Less than 30	35
30-49	45
50-99	55
100-499	70
500-1199	80
1200 and above	90

For areas subject to moderately severe windstorms.

Height Zone (Feet)	Wind Pressure (Lbs. per Sq. Ft.)
Less than 30	25
30-49	30
50-99	40
100-499	45
500-1199	55
1200 and above	60

Insert new paragraph in section 903.3 as follows:

(c) Overhanging eaves and cornices shall be designed and constructed to withstand outward pressures equal to $1\frac{1}{2}$ times the pressures specified in section 903.1.

Remember material in 903.4 as 903.4(a) and insert new paragraph 903.4(b) as follows:

(b) Radio towers and other towers of trussed construction shall be designed to withstand the wind pressures specified in section 903.1, multiplied by the following factors:

Tower, on total projected area of elements, windward side,	
Wind normal to one side,	
3- or 4-cornered tower, with flat or angular sections	2.20

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Wind on corner,	
3-cornered structure	2.20
4-cornered metal structure	2.40
4-cornered wood structure	2.60
Individual elements, on projected area,	
Cylindrical sections	
2 in. or less in diameter	1.00
Over 2 in. in diameter	0.80
Flat or angular sections	1.30

Replace section 903.6 with the following:

The overturning moment due to wind pressure shall not exceed 50 per cent of the moment of stability due to the dead load only, unless the building or structure is securely anchored to the foundation to resist this force.

Replace Table in paragraph 903.7(b) with one of the following depending upon the severity of the wind conditions. See introductory paragraphs.

For areas subject to severe windstorms

Height from Ground to Top of Sign in Feet	Wind Pressure	
	Pounds per Square Foot Solid Signs	Open Signs
Less than 30	39	54
30-49	50	70
50-99	61	85
100-499	77	104

For areas subject to moderately severe windstorms.

Height from Ground to Top of Sign in Feet	Wind Pressure	
	Pounds per Square Foot Solid Signs	Open Signs
Less than 30	28	39
30-49	33	46
50-99	44	62
100-499	50	70

Replace paragraph 909.2(b) with the following:

(b) During erection masonry walls shall not be built higher than 10 times their thickness unless adequately braced or until provision is made for the prompt installation of permanent bracing at the floor or roof level immediately above the story under construction.

Revise table in paragraph 909.3(e) as follows:

Under the heading "Foundations," delete Type B mortar from the types specified for "Walls of Solid Units".

Under the heading "Masonry other than foundation masonry," delete Type B mortar from the types specified for "Piers of Solid Masonry" and Types C & D mortar from the types specified for "Walls of Solid Masonry" (two items).

Replace section 909.14 with one of the following depending upon the severity of the wind conditions. See introductory paragraphs.

For areas subject to severe windstorms.

909.14. Lateral support.

(a) The lateral support required by sections 909.5, 909.6, 909.7, 909.8 and 909.12 shall be at such intervals that the wall panel within vertical and horizontal supports shall not exceed 256 square feet in area.

(b) Such lateral support shall be obtained by reinforced concrete columns at all corners and at intervals specified in paragraph 909.14(a), and by reinforced concrete tie beams below each tier of floor or ceiling joists and on top of all walls to form a coping. Other forms of support, such as masonry buttresses or cross walls and steel framing properly protected for required fire resistance rating, which afford equivalent lateral strength, may be accepted by the building official in lieu of reinforced concrete framing specified.

(c) Reinforced concrete columns specified in paragraph 909.14(b) shall be not less than 8-inch by 12-inch and have not less than four $\frac{5}{8}$ -inch reinforcing rods with $\frac{1}{4}$ -inch ties spaced 12 inches on centers.

(d) Reinforced concrete tie beams specified in paragraph 909.14(b) shall be not less than 8-inch by 8-inch and have not less than four $\frac{5}{8}$ -inch reinforcing rods, two at the top and two at the bottom.

(e) Reinforced concrete coping beams specified in paragraph 909.14(b) shall be not less than 6 inches thick but not less than 64 square inches in cross section and shall have not less than two $\frac{1}{2}$ -inch reinforcing rods. Such coping beams shall be anchored to the tie beam immediately underneath with the equivalent of 8-inch by 12-inch reinforced concrete struts having not less than four $\frac{1}{2}$ -inch reinforcing rods and placed one strut over each column. Coping beams shall be installed on the rake at the end of gables.

(f) Sufficient bonding and anchorage shall be provided between the walls and the horizontal and vertical support members to resist the assumed wind or other horizontal forces, acting either inward or outward.

(g) Piers, buttresses and cross walls relied upon for lateral support shall have sufficient strength and stability to transfer the horizontal forces, acting in either direction, to adjacent structural members or to the ground. When walls are dependent upon floors or roofs for their lateral support, provision shall be made in the building to transfer the lateral forces to the ground.

For areas subject to moderately severe windstorms.

909.14. Lateral support.

(a) The lateral support required by sections 909.5, 909.6, 909.7, 909.8 and 909.12 shall be at such intervals that the wall panel within vertical and horizontal supports shall not exceed 600 square feet in area. It may be obtained by cross walls, piers, or buttresses and by floors and roofs.

(b) Sufficient bonding or anchorage shall be provided between the walls and the supports to resist the assumed wind or other horizontal forces, acting either inward or outward.

(c) Piers, buttresses and cross walls relied upon for lateral support shall have sufficient strength and stability to transfer the horizontal forces, acting in either direction, to adjacent structural members or to the ground. When walls are dependent upon floors or roofs for their lateral support, provision shall be made in the building to transfer the lateral forces to the ground.

APPENDIX L.

Wood Shingle Roof Covering.

Where it is desired to permit wooden shingles in certain areas of the municipality, section 802.2 may be amended to provide for a restricted use of shingles of good grade as follows:

(4) Outside the fire limits, dwellings, private garages and barns, separated by at least twelve feet from other buildings may be roofed with approved vertical grain or edge-grain wooden shingles. The combined thickness of each five shingles measured at the butts shall be not less than two inches. The exposure of such wooden shingles to the weather shall not exceed, on roofs greater than five-24ths pitch, five inches for 16-inch shingles, five and one-half inches for 18-inch shingles, and seven and one-half inches for 24-inch shingles; nor, on roofs with less than five-24ths pitch but not less than one-eighth pitch, three and three-quarters inches for 16-inch shingles, four and one-quarter inches for 18-inch shingles, and five and three-quarters inches for 24-inch shingles. Such shingles shall be firmly nailed to the roof deck with corrosion resistant nails according to accepted good practice. Unless otherwise specified by law, the Commercial Standard for Wood Shingles, CS 31-52 of the U. S. Department of Commerce, shall be accepted as means of establishing the grade of shingles.

APPENDIX M.

Footing Design and Soil Tests.

Footing Design.

The failure to proportion footings according to the pressures they produce on the soil on which they rest, has resulted, in many cases, in uneven settlements in buildings, causing cracked walls, uneven floor levels and other more or less injurious defects, and in some instances, unsafe conditions.

The loads transmitted to the footings vary from time to time, and, except in the case of warehouses and buildings designed for predetermined permanent live loads, floors are seldom fully loaded at any one time. The loads that may be assumed to reach the footings are the live loads remaining when the reductions provided for in section 902.8 are made. By the application of the

provisions of section 905.4(b) the pressures per square foot on the soil under the footings become as nearly uniform as can be reasonably determined.

As an example, taken from actual practice, of the application of this provision let it be assumed that the loads on the lowest columns of a building are as follows:

Group A (representing those columns that carry walls, floors and roof),		
dead load	156,250	pounds
reduced live load	99,400	pounds
gross load	255,650	pounds
Group B (interior columns carrying mostly floors and roofs),		
dead load	50,860	pounds
reduced live load	32,670	pounds
gross load	83,530	pounds
Group C (interior columns carrying floors only),		
dead load	36,500	pounds
reduced live load	35,500	pounds
gross load	72,000	pounds

It will also be assumed that the soil on which the footings will rest will carry safely 6,000 pounds per square foot.

On these assumptions the footings must be at least
 42.6 square feet under Group A columns ($255,650 \div 6,000$),
 13.9 square feet under Group B columns ($83,530 \div 6,000$), and
 12.0 square feet under Group C columns ($72,000 \div 6,000$);
 as in no case shall the full dead loads plus the reduced live loads on a footing exceed the bearing capacity of the soil.

The column on which the reduced live load constitutes the highest percentage of the gross load, will fix the basis for proportioning the areas of the footings considering the dead loads alone. In the case under consideration this is a column of Group C. Dividing the dead load, 36,500 pounds by the required minimum area of footing, 12 square feet, it is found that 3,042 pounds per square foot is the figure to be used in proportioning the footings. On this basis the footings should be
 51.4 square feet for Group A columns ($156,250 \div 3,042$),
 16.7 square feet for Group B columns ($50,860 \div 3,042$), and
 12.0 square feet for Group C columns ($36,500 \div 3,042$).

As these footing areas are either equal or larger than those first found, it is evident that in no case has the allowable load on the soil been exceeded.

Soil Tests.

Procedure for Soil Tests.—In conducting tests to determine the safe sustaining power of the soil the following procedure is suggested:

(1) The soil shall be tested in one or more places and at such level or levels as the conditions may warrant;

(2) The loaded area shall be at least 1 sq. ft. for bearing materials having a presumptive capacity of 10 tons or more per square foot. For other materials the loaded area shall be at least 4 sq. ft. except that when the largest proposed footing has an area less than 40 sq. ft. the building official may allow a test of 1 sq. ft.;

(3) Loads shall be applied by direct weight or by means of a measured pressure that is maintained constant;

(4) Loads shall be applied in increments. The loading under each increment shall not exceed 25 per cent of the proposed safe load. Increments shall be added until the unit pressure on the soil is 50 per cent in excess of the proposed safe load;

(5) Settlement readings shall be referenced to points which will remain stable during the test. Readings shall be taken by a method which assures accuracy to 0.01 in. and preferably to 0.001 in. such as obtained by micrometer dial;

(6) The load increment which makes the total unit load on the soil equal to the proposed safe load, and the increment which makes a 50 per cent excess load, shall be maintained until the settlement in 8 hr. is less than 0.01 in. Intermediate increments of load shall be maintained until the rate of settlement is less than 0.01 in. per hr. The load settlement shall be represented diagrammatically, using the final settlement under each increment.

Determination of Results of Soil Tests.—See section 906.3(b) of the National Building Code.

APPENDIX N.

Protection Against Subterranean Termites.

In those localities of the United States, where danger from subterranean termite attack exists, provision should be made in the building code to guard against the damage caused to wooden construction resulting from such attacks.

As these insects operate entirely under cover, their destruction frequently is not discovered until the infected wooden members have been rendered unsafe. The insects live and propagate underground, and attack wood or fibre products from such sides as may be in contact with the ground. But even at heights of eighteen inches above ground such products are subject to attack. In this latter case, the termites build protective passages of earth and pulverized wood on the faces of masonry supports, or, at times, self-supporting vertical columns to the underside of the material to be attacked. At times chemical treatment of the soil may be necessary.

Where protection against termites is necessary, the following provisions might appropriately be incorporated as section 919.7 of the National Building Code.

919.7. Protection against termites.

(a) Wood used in contact with the ground shall be pressure treated with an approved preservative, in accordance with the recommendations of the American Wood-Preservers Association.

(b) Untreated wood above the ground shall be supported on a barrier of 4 inches or concrete, masonry laid in cement mortar, or on wood which has been impregnated according to standard specifications with chemical preservatives known to be poisonous to termites.

(c) Cracks and voids in concrete or masonry walls, floors and foundations shall be filled with coal tar pitch or coal tar plastic cement.

(d) Continuous metal shields with solid joints shall be provided over foundation walls, piers, and on pipes to prevent the termites from gaining access to the building. The shields shall be formed of corrosion resistant metal, firmly inserted in the masonry, or between the foundation and the wood, with the projecting edge bent downward at an angle of 45 degrees and extending horizontally at least 2 inches from the face of the foundation.

(e) Ample ventilation shall be provided under buildings and under porches—two square feet per 25 linear feet of foundation.

(f) Adequate drainage of soil beneath and around the structure shall be provided.

(g) Form material, grade stakes, or debris shall not be left under floors or porches, or around the foundation walls.

Fuller information on the habits of these insects and their destructive effects may be obtained from the U. S. Department of Agriculture, Washington, D. C., and from the College of Agriculture, University of California, Berkeley, California.

APPENDIX O.

Standards and Other Publications of the National Board of Fire Underwriters.

The standards of the National Board of Fire Underwriters, listed below, have been prepared after thorough study by committees of technical men particularly qualified in the subjects covered by the standards. In addition the National Board of Fire Underwriters has issued a FIRE PREVENTION CODE which should be adopted by the municipality to provide for proper co-ordination of requirements for occupancies of special hazard. Copies of any of these publications may be had on application at the offices of the National Board of Fire Underwriters at 85 John Street, New York 38, N. Y.; 222 West Adams Street, Chicago 6, Ill.; and 465 California Street, San Francisco 4, Cal.

Fire Extinguishing Appliances.

10. First Aid Fire Appliances.
11. Foam Extinguishing Systems.
12. Carbon Dioxide Fire Extinguishing Systems, and Inert Gas for Fire and Explosion Prevention.
13. Sprinkler Systems.
- 13B. Testing and Maintenance of Dry Pipe Valves.
14. Standpipe and Hose Systems.
15. Water Spray Systems for Fire Protection.
16. Combined Foam and Water Spray Systems.
19. Suggested Specifications for Motor Fire Apparatus.

Fire Extinguishing Auxiliaries.

- 20. Centrifugal Fire Pumps.
- 22. Water Tanks for Private Fire Protection Service.
- 23. Fire Department Hose Connections.
- 24. Outside Protection (Yard Piping Systems).
- 26. Valves Controlling Water Supplies.
- 27. Private Fire Brigades.

Flammable Liquids.

- 30. Flammable Liquids.
- 31. Oil Burning Equipment.
- 32. Dry Cleaning Plants.
- 33. Spray Finishing.
- 34. Dip Tanks.
- 37. Internal Combustion Engines, also Coal Gas Producers.
- 38. Discharging Flammable Liquids from Tank Cars, and Petroleum Pipe Lines.

Combustible Solids.

- 40. Cellulose Nitrate Motion Picture Film.
- 42. Pyroxylin Plastic in Factories
- 43. Pyroxylin Plastic in Warehouses and Stores.
- 44. Combustible Fibres.
- 45. Rubber Tire Protection.
- 47. Lumber Yards.
- 48. Magnesium.

Gases.

- 50. Acetylene Equipment.
- 51. Gas Systems for Welding and Cutting.
- 54. Gas Piping and Gas Appliances in Buildings.
- 56. Hospital Operating Rooms.
- 57. Coloring and Ripening of Fruits and Vegetables.
- 58. Liquefied Petroleum Gases.
- 59. Liquefied Petroleum Gases at Utility Gas Plants.

Explosive Dust.

- 60A. Pulverized Coal Systems.
- 61B. Terminal Grain Elevators.
- 61C. Flour and Feed Mills.
- 63. Dust Explosions in Industrial Plants.
- 64. Country Grain Elevators.

Electrical Equipment.

- 70. National Electrical Code.
- 71. Central Station Protective Signaling Systems.
- 72. Proprietary Protective Signaling Systems.
- 73. Municipal Fire Alarm Systems.
- Automatic Fire Alarm Systems for Private Dwellings.

Construction.

- 80. Protection of Openings in Walls and Partitions.
- 81. Fur Storage, Fumigation and Cleaning.

- 82. Incinerators.
- 83. Transit Operations.
- 84. Merchandise Vaults and Safes.
- 86. Class A Ovens and Furnaces.
- 87. Construction and Protection of Piers and Wharves.
- 90A. Air Conditioning and Ventilating Systems of Other Than Residence Type.
- 90B. Residence Type Warm Air Heating and Air Conditioning Systems.
- 91. Blower and Exhaust Systems for Dust, Stock and Vapor Removal.
- 92. Waterproofing of Floors and Drainage, and Installation of Scuppers.

Transportation.

- 307. Operation of Marine Terminals.
- 409. Construction and Protection of Aircraft Hangars.
- 410. Operational Hazards in Aircraft Hangars.
- 502-T. Limited Access Highways, Tunnels and Bridges.

Miscellaneous Publications.

- Special Interest Bulletins for Those Interested in Preventing Loss of Life and Property from Fire.
- Hospitals, Fire Prevention and Protection as Applied to.
- Hotels, Fire Prevention and Protection as Applied to.
- Damage to Fireproof Buildings, Illustrations of.
- Damage to Reinforced Concrete Structures Attending the Southern California Earthquake of March 10, 1933.
- Flood Problem in Fire Prevention and Protection.
- Windstorm Damage Prevention.
- Hurricane Precautions.
- Care and Maintenance of Sprinkler Systems.
- Internal Cleaning of Sprinkler Piping.
- Safeguarding Waterfront Properties.
- National Building Code.
- National Building Code—Abbreviated Edition.
- Code for the Installation of Heat Producing Appliances, Heating, Ventilating, Air Conditioning, Blower and Exhaust Systems.
- Building Codes, Their Scope and Aims.
- Fire Prevention Code.
- Fire Prevention Code—Abbreviated Edition.
- Fire Resistance Ratings.
- Nursing, Convalescent and Old Age Homes, Suggested Ordinance on Existing.
- Bowling Alley Establishments, Fire Hazard of.
- Safety to Life Requirements Applicable to Existing Hospital Buildings.
- Fire Safe School Buildings.

APPENDIX P.

An Ordinance Providing for Fire Limits, and Regulations Governing the Construction, Alteration, Removal, Demolition, Equipment, Use and Occupancy, Location and Maintenance of Buildings and Structures.

Be it ordained by the

Section 1. Adoption of Building Code.

There is hereby adopted by the for the purpose of establishing rules and regulations for the construction, alteration, removal, demolition, equipment, use and occupancy, location and maintenance of buildings and structures, including permits and penalties, that certain building code known as the National Building Code recommended by the National Board of Fire Underwriters, being particularly the 1955 edition thereof and the whole thereof, save and except such portions as are hereinafter deleted, modified or amended, of which not less than three (3) copies have been and now are filed in the office of the Clerk of the.....and the same are hereby adopted and incorporated as fully as if set out at length herein, and from the date on which this ordinance shall take effect, the provisions thereof shall be controlling in the construction of all buildings and structures therein contained within the corporate limits of the

Note.—The name of the community that is adopting the Code should be inserted in the blank spaces.

Section 2. Establishment of Office of Building Official.

(a) The office of building official is hereby created and the executive official in charge shall be known as the building official.

(b) The building official shall be appointed by (name of appointing authority). His appointment shall continue during good behavior and satisfactory service. He shall not be removed from office except for cause after full opportunity has been given him to be heard on specific charges.

(c) During temporary absence or disability of the building official the appointing authority shall designate an acting building official.

Section 3. Qualifications of Building Official.

To be eligible to appointment, the candidate for the position shall have had experience as an architect, structural engineer, building inspector or superintendent of building construction. He shall be in good health, physically capable of making the necessary examinations and inspections. He shall not have any interest whatever, directly or indirectly, in the sale or manufacture of any material, process or device entering into or used in or in connection with building construction, alterations, removal, and demolition.

Section 4. Duties of Building Official.

(a) The building official shall devote his whole time to the duties of his office. He shall receive applications required by this code, issue permits and furnish the prescribed certificates. He shall examine premises for which permits have been issued and shall make necessary inspections to see that the provisions of law are complied with and that construction is prosecuted safely. He shall enforce all provisions of the building code. He shall, when requested by proper authority, or when the public interest so requires, make investigations in connection with matters referred to in the building code and render written reports on the same. To enforce compliance with law, to remove illegal or unsafe conditions, to secure the necessary safeguards during construction, or to require adequate exit facilities in buildings and structures, he shall issue such notices or orders as may be necessary.

(b) Inspections required under the provisions of the building code shall be made by the building official or his duly appointed assistant. The building official may accept reports of inspectors of recognized inspection services, after investigation of their qualifications and reliability. No certificate called for by any provision of the building code shall be issued on such reports unless the same are in writing and certified to by a responsible officer of such service.

(c) The building official shall keep comprehensive records of applications, of permits issued, of certificates issued, of inspections made, of reports rendered, and of notices or orders issued. He shall retain on file copies of required plans and all documents relating to building work so long as any part of the building or structure to which they relate may be in existence.

(d) All such records shall be open to public inspection for good and sufficient reasons at the stated office hours, but shall not be removed from the office of the building official without his written consent.

(e) The building official shall make written reports to his immediate superior once each month, or oftener if requested, including statements of permits and certificates issued, and orders promulgated.

Section 5. Cooperation of Other Officials.

The building official may request and shall receive so far as may be necessary, in the discharge of his duties, the assistance and cooperation of other officials of the municipality.

Section 6. Right of Entry.

The building official, in the discharge of his official duties, and upon proper identification, shall have authority to enter any building, structure or premises at any reasonable hour.

Section 7. Definitions.

(a) Wherever the word "Municipality" is used in the building code, it shall be held to mean the.....

(b) Wherever the term "Corporation Counsel" is used in the building code, it shall be held to mean the Attorney for the

Section 8. Fire Limits Established.

The fire limits of the
are hereby established as follows:

Beginning at
..... to the point of beginning.

Note.—The fire limits should include all closely built districts of predominantly business or commercial occupancy, together with such blocks or portions of blocks surrounding these districts on all sides as constitute an exposure to these districts, including areas where a definite trend toward business or commercial development is manifested. The outer belt of blocks or part blocks surrounding the closely built districts ordinarily should be not less than 200 feet wide.

Section 9. Fees.

(a) No permit as required by the building code shall be issued until the fee prescribed in this ordinance shall have been paid. Nor shall an amendment to a permit be approved until the additional fee, if any, due to an increase in the estimated cost of the building or structure, shall have been paid.

(b) For a permit for the construction or alteration of a building or structure, the fee shall be at the rate of.....dollars per thousand dollars of the estimated cost up to twenty thousand dollars; plus.....dollars per thousand dollars of the estimated cost in excess of twenty thousand dollars up to one hundred thousand dollars; plus.....cents per thousand dollars of the estimated cost in excess of one hundred thousand dollars; but not less than.....dollars in any case; provided that no fee shall be required when the estimated cost does not exceed two hundred dollars.

(c) For a permit for the removal of a building or structure from one lot to another, the fee shall be at the rate of.....dollars per thousand dollars of the estimated value of the building or structure in its completed condition after removal.

(d) For a permit for the removal of a building or structure to a new location within the same lot, the fee shall be at the rate of.....dollars per thousand dollars of the estimated cost of moving, of new foundations and of work necessary to put the building or structure in usable condition in its new location.

(e) For a permit for the demolition of a building or structure the fee shall be at the rate.....dollars for each ten feet in the height of such building or structure plus one per cent additional for each foot of street frontage of the building or structure in excess of fifty feet.

(f) In case of abandonment or discontinuance, the cost of work performed under a permit may be estimated, an adjustment of the fee made and the portion of the fee for uncompleted work returned to the permit holder, provided that no refund of a prescribed minimum fee shall be made. If such discontinuance is due to revocation of permit, a similar adjustment and return may be

made; provided that no refund shall be made until all penalties incurred or imposed by due authority have been collected. After such a refund has been made no work shall be resumed until a new application has been made and a new permit has been issued.

(g) The term "estimated cost" as used in this section, means the reasonable value of all services, labor, materials, and use of scaffolding and other appliances or devices entering into and necessary to the prosecution and completion of the work ready for occupancy; provided that the cost of excavation or grading, and of painting, decorating or other work that is merely for embellishment or not necessary for the safe and lawful use of the building or structure, is not deemed a part of such estimated cost.

Section 10. Saving Clause.

Nothing in this ordinance or in the building code hereby adopted shall be construed to affect any suit or proceeding now pending in any court, or any rights acquired, or liability incurred, nor any cause or causes of action accrued or existing, under any act or ordinance repealed hereby. Nor shall any right or remedy of any character be lost, impaired or affected by this ordinance.

Section 11. Validity.

The invalidity of any section or provision of this ordinance or of the building code hereby adopted shall not invalidate other sections or provisions thereof.

Section 12. Inconsistent Ordinances Repealed.

Ordinances or parts thereof in force at the time that this ordinance shall take effect and inconsistent herewith, are hereby repealed.

Note.—It is well to specify definitely the ordinances or parts of ordinances which are intended to be repealed.

Section 13. Amendments Made in Said Code.

The said code is amended and changed in the following respects:

(1) Section, paragraphs,, and are amended as follows:

Note.—Amendments deemed necessary should be inserted.

Several articles near the end of the Code cover subjects which sometimes are already effectively covered by other existing ordinances. Where a community has a well prepared and effective ordinance on any of these subjects which they wish to keep, the article covering that subject may be deleted. The articles referred to are Article XIII Elevators, Dumbwaiters, Moving Stairways and Amusement Devices, Article XIV Gas Piping and Plumbing, Article XV Electrical Installations, Article XVI Signs and Outdoor Display Structures.

Section 14. Date of Effect.

This ordinance shall take effect days after its approval as required by law.

Note.—Only in unusual circumstances should a building code, which affects so many interests, and these so extensively, be made to take effect immediately upon enactment. A fair allowance would seem to be sixty days. This should give ample time to complete the development of plans, the

SUGGESTED ADOPTING ORDINANCE

preparation of which was begun before the adoption of the code, and on which considerable money had already been expended.

The Board of Appeal established by section 107.1 should be appointed promptly after adoption of the Code. It is suggested that appropriate members would be an architect, a structural or civil engineer, a builder or building contractor, a fire protection engineer and the local Fire Chief.

Article XVII of the Code contains safety to life requirements for existing buildings. These requirements are less severe than required for new buildings and have been found in practice to be reasonable and effective in providing a basis for correction of conditions in existing buildings that present a serious hazard to life.

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FIRE RESISTANCE RATINGS

of

**Beam, Girder and Truss Protections,
Ceiling Constructions,
Column Protections,
Floor and Ceiling Constructions,
Roof Constructions,
Walls and Partitions**

THE NATIONAL BOARD OF FIRE UNDERWRITERS

85 John Street, New York 38, N. Y.

222 West Adams Street, Chicago 6, Ill.

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APRIL, 1959

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Estimated rating on page 18 corrected.

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of the edition dated
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Fire Resistance Ratings

The following tables present for the information of building inspectors and other public officials, architects, engineers and others interested in fire safety in buildings, types of construction which provide fire resistance ratings of 1, 1½, 2, 2½, 3 and 4 hours, as may be required by codes or regulations. The data cover.

- Beam, girder and truss protections
- Ceiling constructions
- Column protections
- Floor and ceiling constructions
- Roof constructions
- Walls and partitions.

The tables are set up in terms of minimum requirements (type, details of construction and thickness of materials) for the specified fire resistance, and in such form as to fit the requirements for hours fire resistance given in building codes. Some constructions, such as brick walls and certain column protections, have obtained test ratings higher than required by building codes, and hence higher than indicated in the tables. For further data the original references, shown by numbers in parenthesis, should be consulted.

The fire resistance rating of a wall or partition or floor and ceiling construction is essentially the time in hours the construction will remain in place and prevent temperatures on the unexposed side from exceeding a certain amount when the construction is exposed to the standard test fire. The fire resistance rating of a column is the time in hours the column will stay in place and carry its load. The usefulness of the assembly after the fire exposure is not taken into account, and damage to the assembly is not necessarily a factor in the rating.

Ratings shown as "Based on Standard Fire Tests" are ratings derived from tests made substantially in accord with the "Standard Methods of Fire Tests of Building Construction and Materials," ASTM E119, NFPA 251, U.L. 263.

Grouped separately from ratings based on standard tests are estimated ratings of certain forms of construction which have been commonly recognized in building codes but for which standard test data have not been available. Such ratings have been included to fill some of the important gaps in the tables of ratings based on standard tests, so that building inspectors and other users of these tables would have some information to go by pending the time when more adequate test data become available.

The data given under estimated ratings do not include details on attachment, but it is assumed that the protection will be securely attached in such a way that it will remain in place during fire exposure.

The tables include the ratings shown in the January, 1959 Building Materials List of Underwriters' Laboratories, Inc. Listings of Underwriters' Laboratories made since that date may include additional ratings. For data on any such ratings see the latest issue of the Building Materials List, which is published by Underwriters' Laboratories, Inc. annually with bi-monthly supplements.

Attention is called to the fact that with ratings based on currently published listings by Underwriters' Laboratories, Inc., there is reasonable assurance that the listed materials will conform in weight, dimension, and quality to those which developed the original test rating, but that with other ratings the materials currently available may not necessarily be the same weight, dimensions and quality as those which were originally tested and rated.

Where an assembly is specified to be of noncombustible materials, care must be exercised in selecting from the tables only assemblies which are made of non-combustible materials.

Analyzing Test Data. In judging and interpreting test results it is necessary to analyze carefully the test data if ratings therefrom are to be on a comparable basis.

With many of the older fire tests the fire exposure differed to a considerable extent from the present standard fire exposure, and with many of the early floor fire tests top surface temperatures were not observed.

FIRE RESISTANCE RATINGS

Many of the tests on columns were made prior to 1925 with column loads somewhat lower than permitted today. In certain cases this necessitates consideration of the effect of greater allowable loads on the fire resistance rating.

Many tests have been made on samples smaller than the minimum size specified in the standard fire test. Such tests cannot be considered the equivalent of tests made on samples of standard size. In some cases they may be satisfactory in determining heat transmission characteristics, from which fairly reliable estimates of the fire resistance rating may be made, provided other characteristics affecting performance of the assembly in the standard fire test have been established, but such estimates must be made with considerable caution.

The above factors have been taken into account in arriving at the ratings shown in the following tables.

Applying Test Results to Modified Forms of Construction. Because small differences in quality of materials, forms of construction and dimensions of parts, in some cases, make large differences in the fire resistance, care must be exercised in applying test ratings to constructions which differ from those actually tested. Some of the factors which need to be considered are the following.

CONCRETE. The fire resistance of concrete depends to a considerable extent on the kind and quality of coarse aggregate used. Siliceous gravel aggregates which contain a large percentage of chert or flint give lower ratings than limestone, trap rock, slag and a number of other aggregates.

The relation between kind of aggregate and fire resistance rating is well illustrated in the ratings given for concrete protections for steel columns.

PLASTER. In constructions where plaster coatings provide an important part of the fire resistance, it is important to note the kind of plaster, its thickness, the type and proportions of the ingredients, and the type and method of fastening the lath. Gypsum plaster is superior to portland cement or lime plaster in resisting heat transmission. Unless asbestos or other fiber is added to portland cement plaster, its fire resistance is further limited by cracking and spalling.

The richness of the plaster mix has a considerable effect on the fire resistance, particularly with gypsum plaster, and if the listed ratings are to be obtained the mix must be as specified.

The increase in fire resistance obtained by addition of a plaster coating is shown in the tables for certain constructions. In general, a facing of $\frac{3}{4}$ -inch portland cement or gypsum plaster will usually increase the fire resistance of a 1-hour assembly by $\frac{1}{2}$ -hour. On 2-, 3- and 4-hour assemblies the increase for the same kind and thickness of plaster will be progressively greater, amounting usually to about 1 hour on a 4-hour assembly. If applied to two sides of a masonry partition the effectiveness is double that of plaster on one side. Plaster coatings, to be effective in adding to the fire resistance periods when combustible structural members are framed in, must be on the exposed faces of the walls opposite to the faces in which the combustible members are inserted.

The use of perlite or vermiculite aggregate in place of sand in plaster, increases its resistance to fire.

WALLBOARD. Special gypsum wallboard or coreboard with a specially formulated core affords greater fire resistance than does the conventional or ordinary type gypsum wallboard or coreboard of the same thickness. If the wallboard or coreboard in the description is "U.L. Listed," wallboard or coreboard having an attached Underwriters' Laboratories, Inc. label stating the same type of construction and design number as that given in the description must be used. Constructions incorporating a special wallboard or coreboard are so noted under details of construction.

HOLLOW UNITS. It should be noted that with hollow constructions and with constructions composed of hollow units the thickness of the hollow space is a relatively minor factor in the fire resistance. Comparative tests have indicated that it is the total thickness of solid material in the unit rather than the total thickness of the unit which is the principal factor. Therefore, with constructions involving hollow block or tile, use of a thicker unit of the same material will increase the rating only if and as the thickness of solid material in the unit is increased. An increase in rating may be obtained by filling the cores.

FIRE RESISTANCE RATINGS

CRITICAL FEATURES IN FIRE RESISTANCE RATINGS. With masonry walls and partitions the critical feature in determining the fire resistance rating under the standard fire test is usually the temperature rise on the unexposed surface or in other words its resistance to heat transmission. However, with some constructions, the critical feature may be the load carrying ability under fire exposure or the resistance to hose stream penetration.

With columns, beams and girders the critical feature is usually the ability to carry the load under fire exposure, which in turn is usually dependent on the heat insulating value of the protective covering and its ability to stay in place during the fire exposure.

With noncombustible floor constructions the critical feature has usually been the temperature rise on the top (unexposed) surface in view of adequate protection provided on the under side, but ceiling protection is important and if deficient the critical feature becomes the load carrying ability under fire exposure which is dependent on the ceiling protection. Where the ceiling protection consists chiefly of plaster on some form of lath the method of attachment of the lath and the security with which it and the plaster are held in place during the fire exposure are often critical features. Falling of any considerable portion of the plaster and lath during the fire exposure period makes the possible collapse of such floors under load (whether of combustible or noncombustible construction) a critical feature in the test results. This has been the case in a number of floor tests.

It should be noted that ratings of plaster facings on walls and partitions are not applicable to similar finishes on ceilings, for under fire exposure plaster may fall from a ceiling considerably before it will fall from a vertical surface, even though it be applied to the same plaster base in both cases.

Fire Walls. Fire resistance ratings as determined by the standard fire test do not provide an adequate basis for specifying minimum thickness of fire walls of buildings. In brief general terms, the standard fire test is made on a sample wall about 10 feet square and to be rated as a 4-hour wall, for example, the sample must stand up under the standard exposure fire and bear its rated load, if of load bearing construction, for a period of 4 hours without attaining a temperature on its unexposed face higher than 250 F. above the starting temperature. The hose stream test which is also specified is made on a like sample exposed to only a 1-hour fire so that this test is not a critical factor in such walls.

It is obvious that a fire test as described will not measure the ability of a wall many times the size of the test panel to stand up against fire exposure extending over more or less its entire area. Walls expand when heated and in severe building fires it is common to see them curl and fall as the result of such expansion on the heated side. Ability to withstand the impact from collapsing floors and falling objects is also important.

When a wall is called upon to stop a spreading fire that is reaching or has attained conflagration proportions it must have stability against collapse or overturning far in excess of that presented by certain types of construction which develop a 4-hour resistance in the standard fire test, if it is to serve its purpose.

Therefore until tests have been developed that will measure the kind of performance required in fire walls of buildings, it is necessary to a considerable extent, as in the National Building Code, to specify thickness and required lateral support of walls on the basis of experience and their performance in actual fires.

GENERAL NOTES

Materials and Forms of Construction

All ratings are based on use of materials and forms of construction in full conformity with requirements of the National Building Code, and in compliance with any applicable material specifications of the American Society for Testing Materials.

The thicknesses of walls, partitions and floor slabs specified in the tables are based on fire resistance only and are not to be construed as permitting such thicknesses where other considerations require greater thicknesses. See for example the Code provisions regarding height and thickness of masonry walls in section 909 of the National Building Code.

FIRE RESISTANCE RATINGS

Ceiling Constructions

Ceiling constructions described under Floor and Ceiling Constructions cannot be used interchangeably with other floor constructions to obtain the fire resistance rating of the floor and ceiling construction from which the ceiling construction was taken.

Openings in a fire resisting ceiling for pipes, ducts and other service equipment should only be permitted on the basis of fire tests of fire resisting ceilings with such openings, except that one electrical outlet box not exceeding 16 square inches in area may be installed in such ceilings in each 90 square feet of ceiling area.

Plaster

Plaster mixes are designated as follows: "1:2, 1:3 gypsum and sand plaster" which indicates two coats of plaster, the first or scratch coat made of 1 part gypsum to 2 parts sand, and the second or brown coat of 1 part gypsum to 3 parts sand.

Plaster proportions are by weight unless otherwise indicated.

Plaster of cement and sand may be richer in cement content than specified for a given rating unless otherwise indicated.

Plaster of gypsum and sand may be richer in gypsum content than specified for a given rating unless otherwise indicated.

Plasters with vermiculite or perlite aggregate must be of the proportions as specified for a given rating.

Thickness of plaster is measured from the face of the plaster base, except that with metal lath it is measured from the back of the lath unless otherwise stated. The usual 1/16 in. white or finish coat of plaster may be included in the required plaster thickness.

Ceilings of plaster on metal lath, unless otherwise specified in individual ratings, may be in contact, furred, or suspended.

Explanatory Notes and References

The abbreviation "Comb." appearing in the tables under Rating means the assembly is rated as combustible according to the Standard Methods of Fire Tests of Building Construction and Materials, NFPA Standard No. 251, U.L. 263. An assembly is rated as combustible when it involves materials in such kind or quantity or so contained as to continue flaming after the furnace is shut off or which does not classify as noncombustible as defined in the National Building Code and NFPA Standard No. 220.

When an assembly is designated as combustible it does not necessarily mean that all the materials in the construction are combustible but that there is a significant amount of combustible material in it.

Letters appearing in the tables as superscripts refer to explanatory notes given at the end of the tables.

Numbers in parenthesis given in the tables under details of construction or details of protection refer to references to sources of data listed at the end of the tables, after the notes.

U.L. refers to Underwriters' Laboratories, Inc.

FIRE RESISTANCE RATINGS

BEAM, GIRDER AND TRUSS PROTECTIONS

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Reinforced Concrete Beams, Girders and Trusses	1½ in. ¹ concrete, coarse aggregate air cooled slag, expanded slag, crushed limestone, calcareous gravel, siliceous gravel or traprock. (62)	4 hrs.
Steel Beams, Girders and Trusses Individually Protected.	1½ in. (measured from face of lath) gypsum-perlite plaster on metal lath cage of self furring metal lath which puts back of lath ¼ in. from steel. Plaster mix: scratch and brown coat 2 cu. ft. U.L. listed perlite to 100 lbs. gypsum. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 5-3 HR (Beam 4 HR) or Design No. 8-4 HR.	4 hrs.
	2 in. (measured from face of lath) U.L. listed vermiculite acoustical plastic or plaster on metal lath cage. Other details as specified in U.L. listing ^c , under Floor or Roof; and Ceiling Constructions—Design No. 10-4 HR (Beam 4 HR.)	4 hrs.
	1½ in. (measured from face of lath) U.L. listed sprayed fiber on metal lath attached to 5/16 in. rod bent around beam. Rod spaced at least 1 in. from bottom flange of beam. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 13-4 HR (Beam 4 HR).	4 hrs.
	3¾ in. U.L. listed sprayed fiber applied directly to adhesive coated steel beam. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 11-4 HR (Beam 4 HR).	4 hrs.
	1⅞ in. (measured from face of lath) U.L. listed sprayed fiber on metal lath bent around ¾ in. U-shaped channels stiffened with ¾ in. or 1 in. channels, putting face of lath 1¾ in. from ¾ in. U.L. listed sprayed fiber on beam. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 6-4 HR (Beam 4 HR).	4 hrs.
	1¼ in. and 1½ in. (measured from face of lath) U.L. listed sprayed fiber on metal lath cage supported by metal lath hangers. 1¼ in. thickness of sprayed fiber on beam cage faces and 1½ in. thickness on beam soffit. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 20-4 HR (Beam 4 HR).	4 hrs.
	1½ in. (measured from face of lath) U.L. listed sprayed fiber on metal lath supported by metal lath hangers. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 15-3 HR (Beam 4 HR).	4 hrs.
	2½ in. (minimum thickness) U.L. listed sprayed fiber applied directly to adhesive coated steel beam. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 14-3 HR (Beam 4 HR).	4 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

BEAM, GIRDER AND TRUSS PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Beams, Girders and Trusses Individually Protected	1½ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 16-4 HR (Beam 4 HR).	4 hrs.
	1½ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported by metal lath hangers. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs of gypsum. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 2-2 HR (Beam 5 HR).	4 hrs.
	1⅝ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported by metal lath hangers. Plaster mix: scratch and brown coat 2½ cu. ft. U.L. listed vermiculite to 100 lbs. of gypsum. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 12-3 HR (Beam 6 HR).	4 hrs.
	2¼ in. U.L. listed perlite acoustical plaster on self furring metal lath supported by metal lath hangers. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions — Design 13-3 HR (Beam 4 HR).	4 hrs.
	1½ in. (measured from face of lath) gypsum-perlite plaster on ribbed metal lath attached to lath hangers wrapped completely around beam. Plaster mix: scratch and brown coats 2½ cu. ft. U.L. listed perlite aggregate to 100 lbs. fibered gypsum. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 15-5 HR (Beam 4 HR).	4 hrs.
	1½ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported by metal lath hangers. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. of U.L. listed vermiculite to 100 lbs. gypsum. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 19-4 HR (Beam 5 HR).	4 hrs.
	2 in. (measured from face of lath) U.L. listed sprayed fiber on ribbed metal lath cage spaced at least 2 in. from bottom of beam flange. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 18-5 HR (Beam 5 HR).	4 hrs.
	1¾ in. (measured from face of lath) U.L. listed perlite acoustical plaster supported by metal lath hangers. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions — Design No. 7-2 HR (Beam 3 HR).	3 hrs.
	2 in. U.L. listed sprayed fiber applied directly to steel beam. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 14-4 HR (Beam 3 HR).	3 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

BEAM, GIRDER AND TRUSS PROTECTIONS—Continued Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Beams, Girders and Trusses Individually Protected	2½ in. U.L. listed sprayed fiber applied directly to adhesive coated steel beam. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 9-4 HR (Beam 3 HR) or Design No. 9-3 HR.	3 hrs.
	1 in. (measured from face of lath) gypsum perlite plaster on metal lath supported by ¾ in. channels boxed around beam, which puts back of lath at least 1½ in. from the bottom and 1¼ in. from edges of structural members. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 6-3 HR (Beam 2 HR).	2 hrs.
	¾ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 7-3 HR (Beam 2 HR).	2 hrs.
	1 in. (measured from face of lath) gypsum vermiculite plaster on metal lath supported by metal lath hangars. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. of U.L. listed vermiculite to 100 lbs. of fibered gypsum. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 3-2 HR (Beam 2 HR).	2 hrs.
	1 15/16 in. and 2⅞ in. thick solid blocks of autoclaved cellular concrete consisting of portland cement, sand and powdered aluminum having an average density of 37 lbs. per cu. ft. securely attached to sides of steel beam and bottom flange respectively by formed wire clips and wires. Side protection resting on bottom flange protection. Joints filled with 1:1:5 (by volume) mortar of portland cement, lime and crushed autoclaved cellular concrete. (113)	2 hrs.
	1⅞ in. (measured from face of lath) U.L. listed sprayed fiber on metal lath cage supported by metal channel framing spaced at least 2 in. below bottom flange of steel member. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 17-5 HR (Beam 2 HR).	2 hrs.
	⅞ in. (measured from face of lath) gypsum vermiculite plaster on metal lath supported by metal hangars anchored in concrete pads over beams. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 1-1½ HR (Beam 1½ HR).	1½ hr.
	1 in. (measured from face of lath) gypsum-perlite plaster on metal lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 3-1 HR (Beam 1 HR).	1 hr.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

BEAM, GIRDER AND TRUSS PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Beams, Girders and Trusses Individually Protected	1½ in. sprayed fiber on metal lath cage supported by metal channel framing spaced at least 3 in. from the bottom and 2 in. from edges of structural members. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 3-3 HR (Beam 1 HR).	1 hr.
Steel Beams, Girders and Trusses Protected by a Ceiling.	Ceiling of 1 in. (measured from face of lath) gypsum-vermiculite plaster, on metal lath supported so as to provide not less than 2½ in. air space between lath and structural members. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. of U.L. listed vermiculite to 100 lbs. fibered gypsum. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 2-4 HR, or Design No. 7-4 HR.	4 hrs.
	Ceiling of ¾ in. (measured from face of lath) U.L. listed cementitious mixture on metal lath suspended beneath structural members and ducts. Lath supported not less than 3½ in. below structural members. Duct opening not to exceed 113 sq. in. in each 100 sq. ft. of ceiling area. Damper protection, duct locations and other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 11-3 HR (Beam 4 HR).	4 hrs.
	Ceiling of 1 in. (measured from face of lath) gypsum-perlite plaster on metal lath, with back plaster on ceiling lath to be not less than 1 in., and on beam 1½ to 3 in., especially at corners. Lath supported so as to provide not less than 3 in. air space between lath and structural members. Steel members to project not more than 8 in. below ceiling surface. Plaster mix: scratch and brown coat 2 to 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 3-4 HR.	4 hrs.
	Ceiling of 5⁄8 in. (measured from face of lath) gypsum-vermiculite plaster covered with ½ in. U.L. vermiculite acoustical plastic or plaster on metal lath supported so as to provide not less than 2½ in. air space between lath and structural members. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 4-4 HR.	4 hrs.
	Ceiling of 1⅝ in. (measured from face of lath) U.L. listed sprayed fiber on metal lath, and ¾ in. sprayed fiber applied directly to structural members, with at least 1½ in. air space between lath supported by ¾ in. channels and ¾ in. protection on the beam. Steel members to project not more than 7 in. below ceiling surface. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 4-3 HR (Beam 4 HR).	4 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

BEAM, GIRDER AND TRUSS PROTECTIONS—Continued Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Beams, Girders and Trusses Protected by a Ceiling. ^j	Ceiling of 15/16 in. (measured from face of lath) U.L. listed cementitious mixture, on metal lath suspended beneath structural members and ducts. Lath supported not less than 3½ in. below structural members. Duct openings not to exceed 113 sq. in. in each 100 sq. ft. of ceiling area. Damper protection and other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 12-4 HR (Beam 4 HR).	4 hrs.
	Ceiling of ¾ in. (measured from face of lath) gypsum-perlite plaster on metal lath suspended beneath structural members and ducts. Lath supported not less than 2¾ in. below structural members. Duct openings not to exceed 70 sq. in. in each 100 sq. ft. of ceiling area. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Damper protection and other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 8-3 HR (Beam 4 HR).	4 hrs.
	Ceiling of ¾ in. (measured from face of lath) gypsum-perlite plaster, on metal lath suspended beneath structural members and ducts. Lath supported not less than 3½ in. below structural members. Duct openings not to exceed 70 sq. in. in each 100 sq. ft. of ceiling area. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Damper protection, duct locations and other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions — Design No. 5-4 HR.	4 hrs.
	Ceiling of ¾ in. (measured from face of lath) gypsum-vermiculite plaster, on metal lath suspended beneath structural members and ducts. Lath supported not less than 3½ in. below structural members. Duct openings not to exceed 85 sq. in. in each 100 sq. ft. ceiling area. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. vermiculite to 100 lbs. fibered gypsum. Damper protection, duct locations and other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions — Design No. 1-3 HR.	3 hrs.
	Ceiling of 1 in. gypsum-vermiculite plaster (measured from face of lath) on metal lath. Plaster mix: 4:1 by weight or approx. 100 lbs. fibered gypsum to 2½ cu. ft. vermiculite. (32)	3 hrs.
	Ceiling of 11/16 in. (measured from face of lath) U.L. listed cementitious mixture on metal lath suspended beneath structural members and ducts. Lath supported not less than 3½ in. below structural members. Duct opening not to exceed 113 sq. in. each 100 sq. ft. of ceiling area. Damper protection, duct locations and other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions — Design No. 10-3 HR.	3 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

BEAM, GIRDER AND TRUSS PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Beams, Girders and Trusses Protected by a Ceiling. ^j	Ceiling of ½ in. gypsum-perlite plaster on 3/8 in. perforated gypsum lath attached to ¾ in. furring channels spaced 12 in. on centers with interlocking wire clips. 14 gauge wire secured diagonally to clips or channels at each intersection. Lath supported not less than 2¾ in. below structural members. Plaster mix: 2½ cu. ft. perlite to 100 lbs. gypsum. (108)	3 hrs.
	Ceiling of 1 in. (measured from face of lath) sprayed fiber on metal lath, with not less than 2 in. air space between lath supported by ¾ in. channels and structural members. Steel members to project not more than 8 in. below ceiling surface. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 2-3 HR (Beam 2 HR).	2 hrs.
	Any ceiling protection described under Floor and Ceiling Constructions, Steel, if the beams, girders or trusses do not extend below the level of the ceiling surface more than 6 in. (see note j).	Same as Rating Floor

Estimated Ratings

Reinforced Concrete Beams, Girders and Trusses	1 in. ^l concrete.	1 hr.
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Type	Details of Protection	Minimum Thickness ¹ Inches, for Rating of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.
Steel Beams, Girders and Trusses individually protected	Clay tile or concrete block; plastered with ½ in. portland cement or gypsum plaster.	—	—	2	2
	Clay tile or concrete block; plastered with ½ in. portland cement or gypsum plaster; all spaces between member and tile or block filled solid.	—	2	2	2
	Clay tile or concrete block; unplastered.	—	—	—	2
	Clay tile or concrete block; unplastered; all spaces between member and tile or block filled solid.	—	—	2	2
	Concrete, Group 1 coarse aggregates ^k ; metal ties bent around beam flanges and other projecting parts.	2	2	1½	1
	Concrete, Group 2 coarse aggregates ^k ; with 3 in. or finer metal mesh placed 1 in. from the finished surface.	2½	2½	2	1½
	Brick, hollow or solid (clay, concrete or sand-lime).	3¾	3¾	2¼	2¼

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

BEAM, GIRDER AND TRUSS PROTECTIONS—Continued

Estimated Ratings—Continued

Type	Details of Protection	Minimum Thickness ¹ Inches, for Rating of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.
Steel Beams, Girders and Trusses individually protected	Gypsum blocks, hollow; plastered with ½ in. gypsum plaster.	3	3	2	2
	Gypsum blocks, hollow; unplastered; joints grouted.	—	3	2	2
	Gypsum blocks, solid; plastered with ½ in. gypsum plaster.	2	2	2	2
	Gypsum blocks, solid; unplastered; joints grouted.	—	—	2	2
	Gypsum poured; plastered with ½ in. gypsum plaster.	1½	1½	1	½
	Gypsum, poured; unplastered.	2	2	1½	1

Type	Details of Protection	Rating
Steel Beams, Girders and Trusses individually protected	Two ¾ in. layers of 1:3 gypsum and sand plaster on metal lath, with ¾ in. air space between.	2½ hrs.
	Two ⅞ in. layers 1:2½ portland cement and sand plaster on metal lath, with ¾ in. air space between.	2 hrs.
	¾ in. 1:3 gypsum and sand plaster on metal lath.	1 hr.
	1 in. 1:2½ portland cement and sand plaster on metal lath.	1 hr.

CEILING CONSTRUCTIONS

Any ceiling construction described under Floor and Ceiling Constructions, provided there are no combustible materials above the ceiling.

Rating
Same as
Floor
Rating

Note. The fire resistance rating of the ceiling constructions described under Floor and Ceiling Constructions is the time in hours the ceiling will protect the structural members above it. Where there is combustible material above the ceiling the fire resistance rating of the ceiling construction will be considerably less than the rating of the floor construction employing the same ceiling protection. See Ceiling constructions under General Notes, page 4.

COLUMN PROTECTIONS

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Cast Iron Columns 7 in. diam. or larger ^m	2 in. ¹ hollow clay tile with outside wire ties ^a ; ¾ in. mortar between tile and column; no fill. (9, 26).....	3 hrs.
	1½ in. portland cement plaster on ¾ in. rib metal lath, with plaster pushed through sufficiently to leave not over ½ in. air space; Plaster mix (by volume): 1:1/10:2½ portland cement, lime and sand; no fill. (9, 26)	3 hrs.
	2 in. concrete, coarse aggregate cinders ^o , 1:2:5 mix; no fill. (9, 26)	2½ hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

COLUMN PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Reinforced Concrete Columns	1½ in. ^l concrete coarse aggregate limestone, calcareous ⁿ gravel, trap rock or blast furnace slag; 12 in. or larger round or square columns. ^m (27)	4 hrs.
	2½ in. concrete, coarse aggregate granite, sandstone, or siliceous gravel ^s ; 16 in. or larger round or square columns. ^m (27)	4 hrs.
	1½ in. concrete, ½ in. coarse aggregate granite, sandstone or siliceous gravel ^s ; covered with 1 in. 1:2½ (by volume) portland cement and sand or gypsum and sand plaster, with admixture of not over ½ part lime; surface of column hacked or column cast in metal lath form, 16 in. or larger round or square columns. ^m (27)	4 hrs.
	1½ in. concrete, coarse aggregate granite, sandstone or siliceous gravel ^s ; light 2 in. mesh expanded metal centrally located in the protective covering. 14 in. or larger round or square columns. ^m (27)	4 hrs.
	1½ in. concrete, coarse aggregate granite, sandstone or siliceous gravel ^s ; light 2 in. mesh expanded metal centrally located in the protective covering. 12 in. or larger round or square columns. ^m (27)	3 hrs.
	1½ in. concrete, coarse aggregate granite, sandstone, or siliceous gravel ^s ; 16 in. or larger round or square columns. ^m (27)	3 hrs.

Type	Details of Protection	Minimum Thickness ¹ Inches, for Rating of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.
Steel Columns 6 x 6 in. or larger ^m	Brick (clay) with brick fill. (26).....	3¾	3¾	3¾	2¼
	Concrete, coarse aggregate calcareous ⁿ or limestone; fill of same material. (9, 26)				
	6 x 6 in. or larger.....	2	1½	1	1
	8 x 8 in. or larger.....	1½	1	1	1
	12 x 12 in. or larger.....	1	1	1	1
	Concrete, coarse aggregate trap rock; fill of same material; steel wire ties ^p . (9, 26)				
	6 x 6 in. or larger.....	2½	2	1½	1
	8 x 8 in. or larger.....	2	1½	1	1
	12 x 12 in. or larger.....	1½	1	1	1
	Concrete, coarse aggregate granite, sandstone, siliceous ^s gravel or cinders ^o ; fill of same material; steel wire ties ^{aa} . (95)				
	6 x 6 in. or larger.....	3	2	1½	1
	8 x 8 in. or larger.....	2½	2	1	1
	12 x 12 in. or larger.....	2	1	1	1

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

COLUMN PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Columns	3 in. concrete block, hollow, cinder; fill of cinder concrete slabs and mortar with $1\frac{1}{4}$ in. mortar between column and blocks ^r . (29)	4 hrs.
	4 in. gypsum block, solid; corrugated metal ties or $\frac{3}{8}$ in. metal mesh in horizontal joints; gypsum block or poured gypsum fill; $\frac{3}{4}$ in. gypsum mortar between column and block. (26)	4 hrs.
	2 in. gypsum concrete, poured; fill of same material; 4 x 4 in. wire mesh reinforcement wrapped around column ^t . (28)	4 hrs.
	2 in. gypsum block, solid; plastered with $\frac{1}{2}$ in. gypsum and sand plaster; $\frac{7}{8}$ in. 12 gauge metal cramps set in holes drilled in blocks to link adjacent blocks of the same course together; no fill. (28)	4 hrs.
	2 in. gypsum block, solid; wire lath strips laid in horizontal joints; fill of gypsum block and mortar with $\frac{1}{2}$ in. mortar between column and blocks and with $\frac{1}{2}$ in. gypsum and sand plaster on outside. (28)	4 hrs.
	3 in. gypsum block, hollow; covered with $\frac{1}{2}$ in. gypsum and sand plaster; $\frac{7}{8}$ in. 12 gauge metal cramps linking adjacent blocks of same course; $\frac{1}{4}$ in. mortar between column flange and block; no fill. (28)	4 hrs.
	4 in. hollow clay tile, two 2 in. layers; $\frac{1}{2}$ in. mortar between tile and column; $\frac{3}{8}$ in. metal mesh in horizontal joints; hollow clay tile fill. (26)	4 hrs.
	2 in. hollow clay tile plastered with $\frac{3}{4}$ in. 1:3 (by volume) gypsum and sand plaster; $\frac{3}{4}$ in. mortar between tile and column; $\frac{3}{8}$ in. metal mesh in horizontal joints; limestone concrete fill. (26)	4 hrs.
	4 in. hollow clay tile plastered with $\frac{5}{8}$ in. 1:2½ (by volume) lime and sand plaster; $1\frac{1}{8}$ in. mortar between tile and column, $\frac{3}{8}$ in. metal mesh in horizontal joints; limestone concrete fill. (26)	4 hrs.
	1½ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath spaced $1\frac{1}{4}$ in. from column with plaster pushed through to column flanges. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. U.L. listed vermiculite plaster aggregate to 100 lb. fibered gypsum. No fill. Other details as specified in U.L. listing ^e , under Column Protection—Design No. 1-4 HR.	4 hrs.
	1½ in. gypsum-vermiculite plaster reinforced with wire mesh, on two layers of $\frac{1}{2}$ in. gypsum lath boxed around column and fastened with wire ties. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. vermiculite to 100 lbs. gypsum. (92)	4 hrs.
	1½ in. gypsum-perlite plaster reinforced with wire mesh, on two layers of $\frac{1}{2}$ in. gypsum lath boxed around column and fastened with wire ties. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (92)	4 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

COLUMN PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Columns	1½ in. (measured from face of lath) gypsum-perlite plaster on metal lath spaced from flanges by ¾ in. steel furring channels at approx. 2 ft. vertical spacings. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. No fill. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 7-4 HR.	4 hrs.
	1¾ in. (measured from face of lath) gypsum-perlite plaster or U.L. listed cementitious mixture on self-furring metal lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum or scratch and brown coat of U.L. listed cementitious mixture. No fill. Other details as specified in U.L. listing ^c under Column Protection—Design No. 6-4 HR.	4 hrs.
	2½ in. (minimum thickness) U.L. listed sprayed fiber applied directly to adhesive coated steel column. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 11-5 HR.	4 hrs.
	2¾ in. (minimum thickness) U.L. listed sprayed fiber applied directly to steel column. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 13-5 HR.	4 hrs
	2⅞ in. perlite-plaster reinforced with plain wire fabric, on paper backed No. 16 gauge welded wire fabric. Plaster mix: 3½ cu. ft. U.L. listed perlite plaster aggregate to 94 lbs. of portland cement. No fill. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 8-4 HR.	4 hrs.
	1¾ in. U.L. listed L-shaped precast concrete units secured to flange of column and metal edge of adjacent unit by steel studs welded in place. Vertical and Horizontal joints filled with a 3:1 mix (by volume) of perlite and cement mortar. Fill of 8:1 mix (by volume) of perlite and cement. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 5-4 HR.	4 hrs
	2⅞ in. gypsum-perlite plaster reinforced with poultry netting, on ½ in. gypsum lath boxed around column. Plaster mix: scratch coat 3½ cu. ft. and brown coat 4 cu. ft. U.L. listed perlite plaster aggregate to 100 lb. unfibered gypsum. No fill. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 4-4 HR.	4 hrs
	1½ in. (measured from face of lath) gypsum-perlite plaster on metal lath spaced 1¼ in. from column with plaster pushed through to column flanges. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite plaster aggregate to 100 lb. fibered gypsum. No fill. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 2-4 HR.	4 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

COLUMN PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Columns	2 in. portland cement vermiculite plaster reinforced with plain wire fabric, on paperbacked No. 16 gauge welded wire fabric. Plaster mix: 4 cu. ft. U.L. listed vermiculite plaster aggregate to 94 lbs. of portland cement. No fill. Other details as specified in U.L. listing, under Column Protection—Design No. 10-4 HR.....	4 hrs.
	1 in. gypsum-vermiculite plaster (measured from face of lath) on metal lath spaced 1 in. from column. Plaster mix: 4:1 by weight or approx. 100 lbs. fibered gypsum to 2½ cu. ft. vermiculite. Loose vermiculite fill. (32)	4 hrs.
	1¾ in. (measured from face of lath) gypsum vermiculite plaster on self-furring metal lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite plaster aggregate to 100 lbs. fibered gypsum. No fill. Other details as specified in U.L. listing, under Column Protection—Design No. 9-4 HR.	4 hrs.
	1½ in. (measured from face of lath) U.L. listed cementitious mixture on metal lath spaced ½ in. from column with cementitious mixture pushed through to column flanges. No fill. Other details as specified in U.L. listing, under Column Protection—Design No. 3-4 HR.	4 hrs.
	3¾ in. (minimum thickness) U.L. listed sprayed fibre applied directly to steel column. Other details as specified in U.L. listing, under Column Protection—Design No. 12-5 HR.	4 hrs.
	1 in. gypsum-perlite plaster reinforced with wire mesh, on two layers of ½ in. gypsum lath boxed around column and fastened with wire ties. Plaster mix: 100 lbs. gypsum to 2½ cu. ft. perlite. (92)	3 hrs.
	1½ in. gypsum-perlite plaster reinforced with wire mesh, on ½ in. gypsum lath boxed around column and fastened with wire ties. Plaster mix: 100 lbs. gypsum to 2½ cu. ft. perlite. (92)	3 hrs.
	1¾ in. gypsum-perlite plaster, on two layers of ½ in. gypsum lath boxed around column and fastened with wire ties. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (92)	3 hrs.
	1¾ in. gypsum-perlite plaster on ¾ in. perforated gypsum lath boxed around column and fastened with wire ties. Corner bead wings not in contact with gypsum lath for full height of column but attached to gypsum lath by approximately 2 in. long extensions spaced 6 in. on centers. Extensions formed by cutting metal wings of corner beads on a diagonal every 6 in. to such a depth that when the resulting loose flaps are folded over they produce approximately 2 in. extensions to the metal wings. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. fibered gypsum. (92)	3 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

COLUMN PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Columns	1¾ in. (measured from face of lath) gypsum-perlite plaster on self-furring metal lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. of perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 6-3 HR.	3 hrs.
	2 in. gypsum and sand plaster on ¾ in. perforated gypsum lath boxed around column and fastened with wire ties. Plaster mix: scratch coat 200 lbs. and brown coat 300 lbs. sand to 100 lbs. fibered gypsum. (90)	3 hrs.
	2 in. hollow clay tile with outside wire ties ^a or with ¾ in. metal mesh in horizontal joints; limestone or trap rock concrete fill, extending 1 in. outside column on all sides. (26).....	3 hrs.
	1 in. (measured from face of lath) gypsum-perlite plaster on metal lath spaced 1¼ in. from column, with plaster pushed through to column flanges. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite plaster aggregate to 100 lb. fibered gypsum. No fill. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 3-3 HR.	3 hrs.
	1¾ in. gypsum-perlite plaster on ¾ in. perforated gypsum lath boxed around column and fastened with wire ties. Corner bead wings not in contact with gypsum lath for full height of column but attached to gypsum lath by 2 in. long extensions spaced 12 in. on centers. Extensions formed by cutting metal wings of corner beads on a diagonal every 12 in. to such a depth that when the resulting loose flaps are folded over they produce 2 in. extensions to the metal wings. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (116)	3 hrs.
	1 in. (measured from face of lath) gypsum-vermiculite plaster on metal lath spaced 1¼ in. from column with plaster pushed through to column flanges. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. U.L. listed vermiculite plaster aggregate to 100 lb. fibered gypsum. No fill. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 1-3 HR.	3 hrs.
	1¼ in. gypsum-vermiculite plaster on two layers ¾ in. perforated gypsum lath boxed around column and fastened with wire ties. Plaster mix: 2¼ cu. ft. U.L. listed vermiculite plaster aggregate to 100 lbs. fibered gypsum. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 5-3 HR.	3 hrs.
	1¾ in. (measured from face of lath) U.L. listed cement and plaster mixture on ¾ in. ribbed metal lath wrapped around column. No fill. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 2-3 HR.	3 hrs.
	2¼ in. (minimum thickness) U.L. listed sprayed fiber applied directly to steel column. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 10-3 HR.	3 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

COLUMN PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Columns	2 in. (minimum thickness) U.L. listed sprayed fiber applied directly to steel. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 7-3 HR.	3 hrs.
	1¾ in. (measured from face of lath) gypsum vermiculite plaster on self-furring metal lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite plaster aggregate to 100 lbs. fibered gypsum. No fill. Other details as specified in U.L. Listing ^c , under Column Protection—Design No. 8-3 HR.	3 hrs.
	1½ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath spaced 1¼ in. from column. Plaster mix: scratch coat 2 cu. ft. of U.L. listed vermiculite to 100 lbs. fibered gypsum and brown coat 4 cu. ft. of U.L. listed vermiculite to 150 lbs. fibered gypsum. No fill. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 9-3 HR.	3 hrs.
	1½ in. gypsum-perlite plaster, on ¾ in. perforated gypsum lath boxed around column and fastened with wire ties. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (92)	2½ hrs.
	Two ¾ in. layers of 1:3 gypsum and sand plaster or two 1 in. layers of 1:2½ portland cement and sand plaster, on metal lath, with ¾ in. air space between the two layers; no fill. (9)	2½ hrs.
	Four layers ½ in. gypsum wallboard. Inner three layers cemented and clinch nailed together, cemented to column flanges and tied to column with double strands 18 gauge tie wire at 15 in. spacing. Outer layer cemented to inner layer; corners cemented and taped. (69)	2½ hrs.
	1 in. gypsum-perlite plaster on ¾ in. perforated gypsum lath boxed around column and fastened with wire ties. Plaster mix: 100 lbs. gypsum to 2½ cu. ft. perlite. (92)	2 hrs.
	2 in. gypsum block, solid; unplastered; 7⁄8 in. 12 gauge metal cramps set in holes drilled in blocks to link adjacent blocks of same course together; no fill. (28)	2 hrs.
	2 in. gypsum block, solid; corrugated metal ties or ¾ in. metal mesh in horizontal joints; gypsum block or poured gypsum fill; ¾ in. gypsum mortar between column and block. (26)	2 hrs.
	3 in. gypsum block, hollow; unplastered; 7⁄8 in. 12 gauge metal cramps linking adjacent blocks of same course; no fill. (28)	2 hrs.
	1 in. (measured from face of lath) gypsum-perlite plaster on self-furring metal lath to fur lath ¼ in. from steel. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 2-2 HR.	2 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

COLUMN PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Columns	1 in. (measured from face of lath) gypsum-perlite plaster on metal lath spaced $1\frac{1}{4}$ in. from column. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite plaster aggregate to 100 lbs. fibered gypsum. No fill. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 1-2 HR.	2 hrs.
	$1\frac{1}{2}$ in. (minimum thickness) U.L. listed sprayed fiber applied directly to steel. Other details as specified in U.L. listing ^c , under Column Protection—Design No. 4-2 HR.	2 hrs.
	$2\frac{1}{2}$ in. plaster, two $\frac{7}{8}$ in. layers 1:1/10:2½ (by volume) portland cement, lime and sand on metal lath; $\frac{3}{4}$ in. air space between layers; no fill. (26)	2 hrs.
	$\frac{5}{8}$ in. 1:2½ gypsum and sand plaster on $\frac{3}{8}$ in. perforated gypsum lath boxed around column and fastened with wire ties. (92)	1½ hrs.
	Three layers $\frac{1}{2}$ in. gypsum wallboard. Inner two layers cemented and clinch nailed together, cemented to column flanges and tied to column with double strands 18 gauge tie wire at 15 in. spacing. Outer layer cemented to inner layer; corners cemented and taped. (69)	1½ hrs.
	Two layers $\frac{1}{2}$ in. gypsum wallboard. Inner layer cemented to column flanges and tied to column with double strands 18 gauge tie wire at 15 in. spacing. Outer layer cemented to inner layer; corners cemented and taped. (69)	1 hr.
	$\frac{3}{4}$ in. 1:3 gypsum and sand plaster or 1 in. 1:2½ portland cement and sand plaster, on metal lath. (9)	1 hr.
	$\frac{1}{2}$ in. 1:2½ gypsum and sand plaster, on $\frac{3}{8}$ in. perforated gypsum lath boxed around column and fastened with wire ties. (92)	1 hr.
	2 in. hollow clay tile with outside wire ties ^a , with or without concrete fill; $\frac{3}{4}$ in. mortar between tile and column. (26)	1 hr.
	1 in. plaster, 1:1/10:2½ (by volume) portland cement, lime and sand on metal lath; no fill. (26)	1 hr.
Timber Columns	$\frac{3}{8}$ in. gypsum wallboard on column and covering cast iron or steel cap (9, 26)	1 hr. comb.
Long leaf pine or douglas fir.	1 in. 1:2½ portland cement and sand plaster on metal lath spaced $\frac{3}{4}$ in. from column. Plaster protecting cast iron or steel cap. (9, 26)	2 hrs. comb.
Minimum area 120 sq. in.		

Estimated Ratings

Steel Column	$1\frac{3}{8}$ in. 1:2, 1:3 gypsum and sand plaster on $\frac{3}{8}$ in. perforated gypsum lath wire tied to column. Additional wire ties around column through portions of corner beads reinforcing plaster.	2 hrs.
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Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Concrete and Tile ^a	6 in. hollow clay tile fillers laid end to end in rows 2½ in. or more apart; reinforcing steel placed between these rows, and concrete cast around and over tile to a depth of 2 in. Ceiling plastered with ⅝ in. 1:3 gypsum and sand plaster. (33)	2 hrs.
	4 in. hollow clay tile fillers laid end to end in rows 2½ in. or more apart; reinforcing steel placed between these rows and concrete cast around and over tile to a depth of 1½ in. Ceiling plastered with ⅝ in. 1:3 gypsum and sand plaster. (33)	1½ hrs.
	4 in. hollow clay tile fillers laid end to end in rows 2½ in. or more apart; reinforcing steel placed between these rows and concrete cast around them and over tile to a depth of 1½ in. Ceiling unplastered. (33)	1 hr.
Gypsum Slab ^a	4 in. reinforced gypsum concrete slab supported on properly protected floor beams; reinforced ¾ in. above bottom of slab; ceiling plastered with ¾ in. gypsum and sand plaster. (18, 19)	3 hrs.
Precast Concrete Plank ^a	6 in. precast plank of autoclaved cellular concrete consisting of portland cement, sand and powdered aluminum and having an average density of 44.5 lbs. per cu. ft. Plank reinforced with six ⅜ in. longitudinal bars having ¾ in. concrete protection to bottom of plank and four 5/16 in. longitudinal bars near the top of the plank. Three ¼ in. cross reinforcing bars per length of plank welded to upper and lower longitudinal reinforcing making a grid of reinforcing bars near the upper and lower surfaces of the plank. Joints between adjacent plank completely filled with grout. (113)	1½ hrs.
	8 in. precast plank of autoclaved cellular concrete consisting of portland cement, sand and powdered aluminum and having an average density of 38 lbs. per cu. ft. Plank reinforced with six ⅜ in. longitudinal reinforcing bars having ¾ in. concrete protection to the bottom of the plank and four 5/16 in. longitudinal reinforcing bars near the top of the plank. Six 5/16 in. cross reinforcing bars per length of plank welded to upper and lower longitudinal reinforcing bars making a grid of reinforcing bars near the upper and lower surfaces of the plank. Joints between adjacent plank completely filled with grout. (113)	1 hr.
	6 in. precast plank of autoclaved cellular concrete consisting of portland cement, sand and powdered aluminum and having an average density of 42.2 lbs. per cu. ft. Plank reinforced with six 5/16 in. longitudinal bars having ¾ in. concrete protection to the bottom of plank and four ¼ in. longitudinal bars near the top of the plank. Three ¼ in. cross reinforcing bars per length of plank welded to upper and lower longitudinal reinforcing making a grid of bars near the upper and lower surfaces of the plank. Shear reinforcement of ⅜ in. bars bent in zigzag shape and wire tied to upper and lower reinforcing grid. Joints between adjacent plank completely filled with grout. (113)	1 hr.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Precast Concrete Units^u (Pre-stressed)	3 in. reinforced concrete topping over 2½ in. thick U.L. listed precast concrete building units. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 5-2 HR.	2 hrs. ^{ff}
Reinforced Concrete^u	<p>4½ in. slab with expanded slag aggregate. ¾ in. protection to steel reinforcement. (62-A)</p> <p>6 in. slab with air-cooled slag aggregate. 1 in. protection to steel reinforcement. (62-J)</p> <p>5 in. slab with limestone aggregate, with electrical raceways and junction boxes^{dd}. Ceiling of 1 in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported from the bottom of the concrete slab. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. (62-K)</p> <p>3 in. slab with limestone aggregate. Ceiling of 1 in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported from the bottom of the concrete slab. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. (62-K)</p> <p>4 in. slab with limestone aggregate, with electrical raceways and junction boxes^{ee}. Ceiling of ¾ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported not less than 1½ in. from the bottom of the concrete slab. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. (62-I)</p> <p>2 in. slab with limestone aggregate. Ceiling of ¾ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported not less than 1½ in. from the bottom of the concrete slab. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. (62-I)</p> <p>2½ in. slab with limestone aggregate. ¾ in. protection to steel reinforcement. Space between concrete joists filled with 3¾ in. by 7¾ in. by 15 9/16 in. concrete masonry units with expanded shale aggregate and having a minimum equivalent thickness^e of 2.72 in. Concrete masonry units laid flush with bottom of concrete joists. (62-N)</p> <p>6 in. slab with traprock aggregate. 1 in. protection to steel reinforcement. (62-L)</p> <p>6 in. slab with crushed limestone aggregate, with electrical raceways and junction boxes. 1 in. protection to steel reinforcement. (62-B,O)</p> <p>6 in. slab with calcareous gravel aggregate. 1 in. protection to steel reinforcement. (62-C)</p> <p>6 in. slab with siliceous gravel aggregate.^a 1 in. protection to steel reinforcement. (62-D,P)</p> <p>4¾ in. slab with air-cooled slag aggregate. ¾ in. protection to steel reinforcement (62-M)</p>	<p>4 hrs.</p> <p>4 hrs.</p> <p>4 hrs.</p> <p>4 hrs.</p> <p>3 hrs.</p> <p>3 hrs.</p> <p>3 hrs.</p> <p>3 hrs.</p> <p>3 hrs.</p> <p>3 hrs.</p> <p>3 hrs.</p> <p>2½ hrs.</p>

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Reinforced Concrete^a	4¾ in. slab with trap rock aggregate. ¾ in. protection to steel reinforcement. (62-E)	2 hrs.
	4¾ in. slab with calcareous gravel aggregate. 1 in. protection to steel reinforcement. (62-F)	2 hrs.
	4¾ in. slab with crushed limestone aggregate. 1 in. protection to steel reinforcement. (62-G)	2 hrs.
	4¾ in. slab with siliceous gravel aggregate. ^a ¾ in. protection to steel reinforcement. (62-H)	2 hrs.
	4 in. slab with siliceous gravel aggregate. ¾ in. protection to steel reinforcement. (33)	1 hr.
	3 in. slab with limestone aggregate. ¾ in. protection to steel reinforcement. (62-Q)	1 hr.
Steel Joists (Fabricated from Rolled Sections or from Strip or Sheet Steel) or Steel Beams^a	2½ in. concrete slab ^v on metal lath, or 2 in. reinforced gypsum slabs covered with ½ in. mortar, on joists. Ceiling of 1 in. gypsum-vermiculite plaster proportioned within the range of 3½ to 5½ cu. ft. vermiculite per 100 lb. gypsum, on metal lath. (9)	4 hrs.
	2 in. concrete slab ^v on metal lath, or 2 in. precast reinforced portland cement concrete or gypsum slabs, on joists, the precast slabs to be finished with top coating of ¼ in. mortar. Ceiling of 2 in. reinforced gypsum tile anchored to joists with metal ties and covered with ½ in. 1:3 gypsum and sand plaster. (9)	4 hrs.
	2 in. concrete slab ^v on metal lath. Ceiling of 1 in. gypsum-perlite plaster on ¾ in. perforated gypsum lath attached to ¾ in. furring channels spaced 12 in. on centers with interlocking wire clips giving continuous support to lath. Plaster reinforced with 20 ga. wire mesh. Wire mesh attached to furring channels at joints in lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (65)	4 hrs.
	2 in. concrete floor slab ^v on metal lath, or 2¾ in. reinforced portland cement concrete plank with joints thoroughly grouted, on joists. Ceiling of 1 in. gypsum-vermiculite plaster (measured from face of lath) on metal lath. Plaster mix: 4:1 by weight or approx. 100 lbs. fibered gypsum to 2½ cu. ft. vermiculite. (32)	3 hrs.
	2½ in. concrete floor slab ^v on metal lath, or 2 in. reinforced gypsum tile covered with ½ in. mortar, on joists. Ceiling of 1 in. unsanded wood-fibered gypsum plaster, or ¾ in. gypsum-vermiculite plaster proportioned within the range of 3½ to 5½ cu. ft. vermiculite per 100 lb. gypsum, on metal lath. (9)	3 hrs.
	2½ in. reinforced gypsum concrete on ¾ in. gypsum plaster board on joists, or 2½ in. cinder concrete on metal floor lath on joists. Ceiling of 2 in. precast, reinforced gypsum ceiling tile suspended ½ in. below 1 in. furring channels in turn suspended ½ in. below joists; gypsum ceiling tile corrugated on under surface for effective plaster bond; all joints grouted with gypsum; ceiling finished with ½ in. 1:1 gypsum and sand plaster. (17)	3 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Joists (Fabricated from Rolled Sections or from Strip or Sheet Steel) or Steel Beams	2½ in. reinforced gypsum concrete on ½ in. gypsum plaster board on joists. Ceiling of 2¼ in. reinforced gypsum concrete attached to bottoms of joists, plastered with ¾ in. gypsum and sand plaster; reinforcement 1 in. above bottom of ceiling slab. (18)	3 hrs.
	2 in. precast, reinforced gypsum slabs on joists; joints grouted with gypsum. Ceiling of 2 in. precast, reinforced gypsum attached to bottoms of joists; joints grouted with gypsum; plastered with ¾ in. gypsum and sand plaster. (20)	3 hrs.
	2⅝ in. reinforced gypsum concrete on ⅜ in. gypsum plaster board supported by joists of which the lower ⅔ is encased in precast gypsum and the upper ⅓ extends into the floor slab; 1 in. minimum fireproofing on joists. Ceiling of ¾ in. 1:1 gypsum and sand plaster on metal lath. (22)	3 hrs.
	2 in. concrete slab on metal lath. Ceiling of ½ in. gypsum-perlite plaster, on ⅜ in. perforated gypsum lath attached to ¾ in. furring channels spaced 16 in. on centers, with special wire clips giving continuous support to lath. Plaster reinforced with 20 gauge wire mesh. Wire mesh attached to furring channels at joints in lath. Plaster mix: 2½ cu. ft. perlite to 100 lbs. gypsum. (65)	3 hrs.
	2 in. concrete slab on metal lath. Ceiling of ⅝ in. gypsum-perlite plaster on ⅜ in. perforated gypsum lath attached to ¾ in. furring channels spaced 12 in. on centers, with interlocking wire clips giving continuous support to lath. Plaster reinforced with 14 gauge galvanized wire secured diagonally to clips or channels at each intersection. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (65)	3 hrs.
	2 in. concrete floor slab on metal lath. Ceiling of ⅝ in. gypsum perlite plaster on ¾ in. perforated gypsum lath attached to ¾ in. furring channels spaced 12 in. on centers with special wire clips at edges of lath and third points of lath width at each channel. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. to 100 lbs. gypsum. (65)	3 hrs.
	2½ in. perlite concrete slab on paper-backed wire fabric. Ceiling of ¾ in. gypsum perlite plaster (measured from face of lath) on metal lath secured to joists with wire clips. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibred gypsum. Other details as specified in U.L. listing, under Floor or Roof, and Ceiling Constructions—Design No. 6-3 HR.	3 hrs.
	2½ in. concrete slab on metal lath. Ceiling: 1 in. sprayed asbestos fiber on metal lath. (33)	2½ hrs.
	2 in. concrete floor slab on metal lath, or 2 in. reinforced gypsum tile covered with ¼ in. mortar, on joists. Ceiling of 1 in. unsanded wood-fibred gypsum plaster, or ¾ in. gypsum-vermiculite plaster proportioned within the range of 3½ to 5½ cu. ft. vermiculite per 100 lb. gypsum, on metal lath. (9)	2½ hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Joists (Fabricated from Rolled Sections or from Strip or Sheet Steel) or Steel Beams ^u	2 in. concrete slab ^v on metal lath. Ceiling of ½ in. gypsum-perlite plaster applied to ¾ in. perforated gypsum lath secured to ¾ in. furring channels spaced 16 in. on centers, with interlocking wire clips giving continuous support to lath. 14 gauge galvanized wire secured diagonally to clips or channels at each intersection. Plaster mix: 2½ cu. ft. perlite to 100 lbs. gypsum. (65)	2½ hrs.
	2½ in. concrete slab ^v on metal lath. Ceiling: ¾ in. sprayed asbestos fiber on metal lath. (33)	2 hrs.
	2¼ in. concrete floor slab ^v on metal lath, or 2 in. reinforced gypsum tile covered with ¼ in. mortar finish, on joists. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (9)	2 hrs.
	2½ in. floor slab consisting of 2 in. reinforced gypsum concrete on ½ in. gypsum form boards. Ceiling of ⅝ in. gypsum-perlite plaster on ¾ in. perforated gypsum lath attached to ¾ in. furring channels spaced 12 in. on centers, with interlocking wire clips giving continuous support to lath. 14 gauge galvanized wire secured diagonally to clips or channels at each intersection. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (88)	2 hrs.
	2 in. limestone concrete on paper-backed wire fabric. Ceiling of ¾ in. thick U.L. listed perforated acoustical tile attached to joists with special clips and suspension splines. Special clips attached to ¾ in. channels spaced 4 ft. on center. 4 in. U.L. listed insulating batts placed on top of unexposed surface of acoustical tile. Other details as specified in U.L. listing ^e , under Floor or Roof, and Ceiling Constructions—Design No. 1-2 HR.	2 hrs.
	2 in. concrete on metal lath. Ceiling of 1 in. thick U.L. listed perforated acoustical tile attached to joists with special clips and suspension splines. Special runners spaced 12 in. on centers attached to steel joists with clips. Other details as specified in U.L. listing ^e , under Floor or Roof, and Ceiling Constructions — Design No. 6-2 HR.	2 hrs.
	2 in. (measured from face of lath) reinforced concrete slab on metal lath. Ceiling of ⅝ in. U.L. listed core-board ^{cc} base layer secured to ⅞ in. nailing channels with 1¼ in. annular type nails having 5/16 in. heads spaced 9 in. on centers. ½ in. U.L. listed wallboard ^{cc} face layer over coreboard secured to separate ⅞ in. nailing channels with 1¾ in. annular type nails having 5/16 in. heads spaced 6 in. on centers. Joints of 2 layers staggered and not taped or cemented. Other details as specified in U.L. listing ^e , under Floor or Roof, and Ceiling Constructions—Design No. 2-1½ HR.	1½ hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Joists (Fabricated from Rolled Sections or from Strip or Sheet Steel) or Steel Beams ^u	2 in. reinforced concrete slab on metal lath (measured at joists). Ceiling of two layers of $\frac{5}{8}$ in. U.L. listed wallboard ^c secured to $\frac{7}{8}$ in. nailing channels spaced 16 in. on centers. First layer applied with long dimension at right angles to nailing channels and secured to nailing channels by $1\frac{1}{4}$ in. long annular nails having $\frac{5}{16}$ in. heads and spaced 8 in. on centers. End butt joints held together by "H" clips spaced 8 in. on centers. Outside layer applied with long dimension at right angles to nailing channels, and positioned so that there are no through joints between layers. Secured to nailing channels by $1\frac{7}{8}$ in. long annular nails having $\frac{5}{16}$ in. heads and spaced 8 in. on centers. End butt joints secured to first layer by $1\frac{1}{2}$ in. long screw spaced 12 in. on centers. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 3-1 $\frac{1}{2}$ HR.	1 $\frac{1}{2}$ hrs.
	2 in. concrete floor slab ^v on metal lath, or 2 in. reinforced gypsum tile, on joists. Ceiling of $\frac{3}{4}$ in. 1:2, 1:3 gypsum and sand plaster, or $\frac{3}{4}$ in. 1:2, 1:3 portland cement and sand plaster with 3 lb. asbestos fiber and 15 lb. hydrated lime per bag cement, on metal lath. (9)	1 $\frac{1}{2}$ hrs.
	2 in. concrete slab ^v on metal lath. Ceiling of 1 in. gypsum-perlite plaster, applied to $\frac{3}{8}$ in. perforated gypsum lath attach to $\frac{3}{4}$ in. furring channels spaced 16 in. on centers, with interlocking wire clips giving continuous support to lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. fibered gypsum. (65)	1 $\frac{1}{2}$ hrs.
	2 in. floor slab, consisting of $1\frac{1}{2}$ in. reinforced gypsum concrete on $\frac{1}{2}$ in. gypsum form boards. Ceiling of $1\frac{1}{2}$ in. gypsum-perlite plaster on $\frac{3}{8}$ in. perforated gypsum lath, attached to $\frac{3}{4}$ in. furring channels. spaced 12 in. on centers, with interlocking wire clips giving continuous support to lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. fibered gypsum. (65)	1 $\frac{1}{2}$ hrs.
	2 in. concrete slab ^v on metal lath. Ceiling: $\frac{5}{8}$ in. sprayed asbestos fiber on metal lath. (33)	1 $\frac{1}{2}$ hrs.
	2 in. (measured from face of lath) reinforced concrete slab on metal lath. Ceiling of $\frac{5}{8}$ in. U.L. listed wallboard ^c or $\frac{5}{8}$ in. U.L. listed coreboard ^c , secured to $\frac{3}{4}$ in. furring channels, with sheet-metal screws, or $\frac{7}{8}$ in. nailing channels with $1\frac{1}{4}$ in. nails. Joints in wallboard or coreboard not taped or cemented. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 5-1 HR.	1 hr.
	2 in. concrete floor slab ^v on metal lath. Ceiling of $\frac{1}{2}$ in. gypsum-perlite plaster, on $\frac{3}{8}$ in. perforated gypsum lath attached to $\frac{3}{4}$ in. furring channels spaced 16 in. on centers, with special wire clips at edges of lath and midpoint of lath width at each channel. Plaster mix: 2 $\frac{1}{2}$ cu. ft. perlite to 100 lbs. gypsum. (65)	1 hr.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Joists (Fabricated from Rolled Sections or from Strip or Sheet Steel) or Steel Beams ^u	2 in. concrete slab ^v on metal lath. Ceiling of $\frac{5}{8}$ in. gypsum-perlite plaster, applied to $\frac{3}{4}$ in. perforated gypsum lath attached to $\frac{3}{4}$ in. furring channels spaced 16 in. on centers, with interlocking wire clips giving continuous support to lath. Plaster mix: $2\frac{1}{2}$ cu. ft. perlite to 100 lbs. gypsum. (65)	1 hr.
	2 in. reinforced concrete slab on metal lath. Ceiling of $\frac{5}{8}$ in. U.L. listed wallboard ^c , secured to $\frac{3}{4}$ in. furring channels spaced 16 in. on centers, with sheet-metal screws, or to $\frac{7}{8}$ in. nailing channels with $1\frac{1}{4}$ in. nails. Joints in wallboard not taped or cemented. Other details as specified in U.L. listing ^c under Floor and Ceiling Constructions—Design No. 2-1 HR.	1 hr.
	2 in. reinforced concrete slab on metal lath. Ceiling of $\frac{5}{8}$ in. gypsum-perlite plaster applied to $\frac{3}{8}$ in. U.L. listed perforated gypsum lath attached to $\frac{3}{4}$ in. furring channels spaced 16 in. on centers, with interlocking wire clips giving continuous support to lath. Abutting ends of lath secured to each other with metal finger clips. Plaster mix: scratch coat and brown coat $2\frac{1}{2}$ cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 7-1 HR.	1 hr.
	$\frac{3}{4}$ in. wood flooring nailed to wood sleepers on covering of asbestos paper weighing 14 lb. per 100 sq. ft. cemented on sheet steel deck. Ceiling of $\frac{3}{4}$ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (9)	1 hr. comb.
Steel Plate Deck on Steel Joists (or Beams) ^u	2 in. reinforced vermiculite concrete on steel plate deck. Ceiling of 1 in. gypsum-vermiculite plaster, (measured from face of lath) on metal lath supported at least 7 in. below underside of steel floor plates, and spaced at least $2\frac{1}{2}$ in. from steel members. Plaster mix: scratch coat 2 to $2\frac{1}{2}$ cu. ft. and brown coat 3 to $3\frac{1}{2}$ cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing ^c , under Floor or Roof and Ceiling Constructions—Design No. 2-4 HR.	4 hrs.
	$2\frac{1}{2}$ in. concrete on steel plate deck. Ceiling of 1 in. gypsum-vermiculite plaster proportioned within the range of $3\frac{1}{2}$ to $5\frac{1}{2}$ cu. ft. vermiculite per 100 lb. gypsum on metal lath. (9)	4 hrs.
	2 in. concrete on steel plate deck. Ceiling of 2 in. reinforced gypsum tile with $\frac{1}{2}$ in. 1:3 gypsum and sand plaster. Tile clipped to channels which are clipped to joists. (9)	4 hrs.
	$2\frac{1}{2}$ in. concrete on steel plate deck. Ceiling of 1 in. unsanded, wood-fibered gypsum plaster, or $\frac{3}{4}$ in. gypsum-vermiculite plaster proportioned within the range of $3\frac{1}{2}$ to $5\frac{1}{2}$ cu. ft. vermiculite per 100 lb. gypsum, on metal lath. (9)	3 hrs.
	$2\frac{1}{2}$ in. cinder concrete plus $\frac{1}{2}$ in. cement mortar finish, on steel plate deck. Ceiling of $1\frac{1}{8}$ in. 1:1 gypsum and sand plaster on metal lath. (9)	3 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Plate Deck on Steel Joists (or Beams) ^a	2½ in. concrete on steel plate deck. Ceiling of 1 in. 1:2 gypsum and sand plaster on metal lath. (9)	2½ hrs.
	2 in. concrete on steel plate deck. Ceiling of 1½ in. 1:1 gypsum and sand plaster, on metal lath; or ceiling of 1½ in. 1:2 gypsum and sand plaster on ribbed metal lath. (9)	2½ hrs.
	2 in. concrete on steel plate deck. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster, or 1 in. 1:2, 1:2½ portland cement and sand plaster with 10 lb. hydrated lime added per bag cement, on metal lath. (9)	2 hrs.
	2 in. concrete on steel plate deck. Ceiling of 2 in. interlocking unreinforced gypsum tile supported on upper face of lower beam flange, with ½ in. 1:3 gypsum and sand plaster. (9)	2 hrs.
	1½ in. concrete on steel plate deck. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (9)	1½ hrs.
	1 in. concrete on steel plate deck. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (33)	1 hr.
Steel Units ^a , Cellular	2 in. cinder concrete (minimum thickness over cells) on top of U.L. listed cellular steel floor units. Ceiling ¾ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported by ¾ in. furring channels attached to 1½ in. runner channels secured to bottom of floor units. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 1-4 HR.	4 hrs.
	2 in. perlite concrete (minimum thickness over cells) on top of U.L. listed cellular steel floor units. Ceiling of 1 in. (measured from face of lath) gypsum-perlite plaster on metal lath, with back plaster on lath to be not less than 1 in. Lath supported not less than 3 in. from underside of steel floor units. Plaster mix: scratch and brown coat 2 to 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 3-4 HR.	4 hrs.
	2½ in. (minimum thickness over cells) crushed limestone concrete on top of U.L. listed cellular steel floor units. Ceiling of 1¼ in. U.L. listed sprayed fiber applied directly to underside of steel floor units with web area between cells coated with adhesive. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 13-4 HR, or No. 14-4 HR.	4 hrs.
	2½ in. (minimum thickness over cells) limestone concrete on top of U.L. listed cellular steel floor units. Ceiling of 1½ in. U.L. listed sprayed fiber applied directly to underside of adhesive coated cellular steel units. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 11-4 HR.	4 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Units ^a , Cellular	2½ in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of 1½ in. (measured from face of lath) plaster consisting of ⅝ in. gypsum-vermiculite plaster and ½ in. U.L. listed vermiculite acoustical plastic or plaster on metal lath. Lath supported not less than 7¼ in. from underside of steel floor units. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. Other details as specified in U.L. listings ^c , under Floor or Roof, and Ceiling Constructions—Design No. 4-4 HR.	4 hrs.
	2 in. reinforced concrete on top of U.L. listed cellular steel floor units. Ceiling of ⅞ in. (measured from face of lath) gypsum-perlite plaster on metal lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Lath supported not less than 15½ in. from underside of steel floor, and spaced at least 3½ in. below steel beams. Duct opening in ceiling not larger than 70 sq. in. in each 100 sq. ft. ceiling area, protected by fire damper of No. 12 USS gauge steel covered with two 1/32 in. thick layers of asbestos paper. Also No. 12 USS gauge steel fire damper at junction between branch duct and main duct. Duct location, and other details as specified in U.L. listings ^c , under Floor or Roof, and Ceiling Constructions—Design No. 5-4 HR.	4 hrs.
	2 in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of 1½ in. U.L. listed sprayed fiber on metal lath. Lath supported not less than 4½ in. from underside of steel floor. Other details as specified in U.L. listings ^c , under Floor or Roof, and Ceiling Constructions—Design No. 6-4 HR.	4 hrs.
	1½ in. concrete plus ½ in. cement mortar finish, on top of cellular steel units. Ceiling of 1 in. gypsum-vermiculite plaster proportioned within the range of 3½ to 5½ cu. ft. vermiculite per 100 lb. gypsum, on metal lath secured not less than 2 in. below bottom of cellular steel units. (9)	4 hrs.
	3¼ in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of 1 in. gypsum-perlite plaster (measured from face of lath) on ribbed metal lath. Plaster mix: scratch and brown coats 2½ cu. ft. U.L. listed perlite aggregate to 100 lbs. fibered gypsum. Other details as specified in U.L. listings ^c , under Floor and Roof, and Ceiling Constructions—Design No. 15-5 HR.	4 hrs.
	1½ in. concrete plus ½ in. cement mortar finish, on top of cellular steel units. Ceiling of 1 in. unsanded wood-fibered gypsum plaster on metal lath secured not less than 9 in. below bottom of cellular steel units. (9)	4 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Units, Cellular	2½ in. (minimum thickness over cells) limestone concrete on top of U.L. listed cellular steel floor units. Ceiling of ⅝ in. U.L. listed sprayed fiber applied directly to underside of adhesive-coated cellular steel units. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 16-4 HR.	4 hrs.
	2½ in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of 1½ in. U.L. listed sprayed fiber applied directly to underside of adhesive-coated cellular steel floor units. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 17-5 HR.	4 hrs.
	2½ in. (minimum thickness over cells) reinforced concrete on top of U.L. listed cellular steel floor units. Ceiling of 1 in. U.L. listed sprayed fiber applied directly to underside of adhesive coated cellular steel units. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 18-5 HR.	4 hrs.
	2½ in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of 11/16 in. (minimum thickness) U.L. listed vermiculite acoustical plastic or plaster applied directly to underside of steel floor units; 1⅝ in. plastic or plaster thickness (measured from face of lath) at single cell floor units applied to metal lath over ¾ in. insulation board. Metal lath attached to steel floor units. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 19-4 HR.	4 hrs.
	2½ in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of ½ in. (minimum thickness) U.L. listed sprayed fiber applied directly to underside of steel floor units. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 20-4 HR.	4 hrs.
	2½ in. (minimum thickness over cells) concrete on top of cellular steel floor units. Ceiling of ½ in. gypsum-perlite plaster, on ⅜ in. perforated gypsum lath supported not less than 7¼ in. from underside of floor units and attached to ¾ in. furring channels spaced 12 in. on centers with steel wire clips giving continuous support to lath. Plaster mix: 2½ cu. ft. perlite to 100 lbs. gypsum. (108)	3 hrs.
	1½ in. concrete plus ½ in. cement mortar finish, on top of cellular steel units. Ceiling of 1 in. unsanded wood-fibered gypsum plaster on metal lath secured not less than 2 in. below bottom of cellular steel units. (9)	3 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Units ^a , Cellular	2 in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of $\frac{7}{8}$ in. (measured from face of lath) gypsum-perlite plaster on metal lath suspended not less than $14\frac{3}{4}$ in. from underside of floor units, and spaced at least $2\frac{3}{4}$ in. below steel beams. Lath attached to $\frac{3}{4}$ or 1 in. furring channels spaced 12 in. on centers, which are attached to $1\frac{1}{2}$ in. runner channels spaced 48 in. on centers. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Duct opening in ceiling not to exceed 70 sq. in. in each 100 sq. ft. ceiling area, protected by fire damper of No. 12 USS gauge steel covered each side with $\frac{1}{16}$ in. thick layer of asbestos paper. Also No. 12 USS gauge steel fire damper at junction between branch duct and main duct. Duct location and other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 8-3 HR.	3 hrs.
	2 in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of $\frac{7}{8}$ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath. Face of lath supported not less than $15\frac{3}{8}$ in. from underside of floor units. Plaster mix: scratch coat 2 to $2\frac{1}{2}$ cu. ft. and brown coat 3 to $3\frac{1}{2}$ cu. ft. vermiculite to 100 lbs. fibered gypsum. Duct opening in ceiling not larger than 85 sq. in. in each 100 sq. ft. ceiling area, and protected by No. 14 USS gauge fire damper. Duct location and other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 1-3 HR.	3 hrs.
	2 in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of 1 in. U.L. listed sprayed fiber on face of adhesive coated ribbed metal lath. Lath supported not less than $4\frac{1}{2}$ in. from underside of steel floor units. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 2-3 HR.	3 hrs.
	$2\frac{1}{2}$ in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of $1\frac{1}{2}$ in. (minimum thickness) U.L. listed sprayed fiber applied directly to underside of adhesive coated cellular steel units. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 3-3 HR.	3 hrs.
	2 in. (minimum thickness over cells) reinforced concrete on top of U.L. listed cellular steel floor units. Ceiling of $1\frac{1}{8}$ in. U.L. listed sprayed fiber on face of adhesive coated metal lath. Lath supported not less than $4\frac{1}{2}$ in. from underside of steel floor units. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 4-3 HR.	3 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Units^u, Cellular	2½ in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of ¾ in. (minimum thickness) U.L. listed sprayed fiber applied directly to underside of adhesive-coated cellular steel units. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 9-3 HR.	3 hrs.
	2½ in. (minimum thickness over cells) concrete on top of U.L. listed cellular and fluted steel floor units. Ceiling of 1 7/16 in. (minimum thickness) U.L. listed vermiculite acoustical plastic or plaster applied directly to steel floor units. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 12-3 HR.	3 hrs.
	2½ in. (minimum thickness over cells) concrete on top of U.L. listed cellular and fluted steel floor units. Ceiling of ¾ in. (minimum thickness) U.L. listed sprayed fiber applied directly to underside of adhesive coated steel floor units. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 14-3 HR or Design No. 15-3 HR.	3 hrs.
	2 in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of ¾ in. (measured from face of lath) U.L. listed cementitious mixture on metal lath. Lath supported not less than 15½ in. from underside of steel floor units. Duct opening in ceiling not larger than 113 sq. in. in each 100 sq. ft. ceiling area, and protected by No. 14 USS gage fire damper. Duct locations and other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 11-3 HR.	3 hrs.
	2½ in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of ½ in. (minimum thickness) U.L. listed vermiculite acoustical plastic or plaster applied directly to underside of steel floor units. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 2-2 HR.	2 hrs.
Steel Units^u, Corrugated	4½ in. (measured from bottom of corrugations) concrete on top of U.L. listed corrugated steel floor units. Ceiling of 1 in. (measured from face of lath) gypsum-vermiculite plaster on metal lath. Lath supported not less than 14½ in. from underside of steel floor. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. vermiculite to 100 lbs. gypsum. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 7-4 HR.	4 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Units ^a , Corrugated	4½ in. (measured from bottom of corrugations) expanded slag concrete on top of U.L. listed corrugated steel floor units. Ceiling of ¾ in. gypsum-perlite plaster (measured from face of lath attached directly to steel floor units) on metal lath, and sufficient plaster pushed through the lath to fill the corrugations of the steel floor units. Plaster mix: scratch and brown coat 2 cu. ft. U.L. listed perlite to 100 lbs. gypsum. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 8-4 HR.	4 hrs.
	4½ in. (measured from bottom of corrugations) limestone concrete on top of U.L. listed corrugated steel floor units. Ceiling of 7⁄8 in. (measured from the bottom of the corrugations) U.L. listed sprayed fiber applied directly to underside of adhesive coated corrugated steel floor units. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 9-4 HR.	4 hrs.
	4½ in. (measured from bottom of corrugations) limestone concrete on top of U.L. listed corrugated steel floor units. Ceiling of ½ in. (measured from the bottom of the corrugations) U.L. listed vermiculite acoustical plastic or plaster applied directly to underside of corrugated steel floor units. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 10-4 HR.	4 hrs.
	4½ in. (measured from bottom of corrugations) expanded slag concrete on top of U.L. listed corrugated steel floor units. Ceiling of ¾ in. gypsum-perlite plaster (measured from face of lath attached directly to steel floor units) on metal lath, and sufficient plaster pushed through the lath to fill the corrugations of the steel floor units; 1 in. plaster thickness to the face of the lath in an area 3 ft. square centered below electrical raceway junction box; not more than one junction box in each 90 sq. ft. floor area. Plaster mix: scratch and brown coat 2 cu. ft. U.L. listed perlite to 100 lbs. gypsum. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 5-3 HR.	3 hrs.
	4½ in. (measured from bottom of corrugations) reinforced expanded shale concrete on top of U.L. listed corrugated steel floor units. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 7-3 HR.	3 hrs.
	4½ in. (measured from bottom of corrugations) reinforced expanded shale concrete on top of U.L. listed cellular and corrugated steel form units. (3¾ in. minimum thickness concrete cover over cellular form units). Ceiling of 1 in. U.L. listed perlite acoustical plaster applied directly to underside of steel form units. 2½ in. plaster thickness under electrical junction boxes. Header ducts in concrete limited to not more than three in each 180 sq. ft. of floor area. Duct locations and other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 13-3 HR.	3 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Units ^a , Corrugated	4½ in. (measured from bottom of corrugations) reinforced expanded shale concrete on top of U.L. listed corrugated steel form units and ¾ in. (minimum thickness over cells) on top of U.L. listed steel form units. Ceiling of 1 in. U.L. listed perlite acoustical plaster under cellular form units; 7/8 in. U.L. listed perlite acoustical plaster under header ducts; 2 in. U.L. listed perlite acoustical plaster under junction boxes. Plaster applied directly to steel form units in areas mentioned above. Not more than three header ducts in each 180 sq. ft. floor area. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 7-2 HR.	2 hrs.
	5¼ in. (measured from bottom of corrugations) reinforced limestone concrete on top of U.L. listed corrugated steel floor units. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 3-2 HR.	2 hrs.
	4½ in. (measured from bottom of corrugations) crushed limestone concrete on top of U.L. listed corrugated steel floor units. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 3-1 HR, or No. 4-1 HR.	1 hr.
Steel Units ^a , Ribbed	2 in. (minimum thickness) concrete on top of U.L. listed ribbed steel floor units. Ceiling of 15/16 in. (measured from face of lath) U.L. listed cementitious mixture on metal lath suspended not less than 1½ in. from ribs of floor units, and spaced at least 3½ in. below steel beams. Lath attached to ¾ in. furring channels supported by 1½ in. runner channels. Furring channels spaced not more than 13½ in. on centers. Duct opening in ceiling not larger than 113 sq. in. in each 100 sq. ft. ceiling area, protected by fire damper of No. 14 USS gauge steel. Other details as specified in U.L. listing ^c , under Floor or Roof, and Ceiling Constructions—Design No. 12-4 HR.	4 hrs.
Heavy Timber	6 in. laminated plank floor with 1 in. finish flooring on top. (31)	1 hr. comb.
Wood Joists	Wood floor consisting of 1 in. (nominal) tongue and groove sub and finish flooring, with building paper between. Ceiling of ½ in. gypsum-perlite plaster on ¾ in. plain gypsum lath nailed to joists with 1½ in. nails having ¾ in. diameter heads. Plaster reinforced with 1 in. mesh wire fabric nailed to joists through lath, with 2¾ in. nails having ¼ in. diameter heads. Plaster mix: scratch and brown coats, 2½ cu. ft. perlite to 100 lbs. fibered gypsum. (51)	1½ hrs. comb.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Wood Joists	Wood floor consisting of 1 in. (nominal) tongue and groove sub and finish flooring with building paper between. Ceiling of $\frac{3}{4}$ in. gypsum-vermiculite plaster on metal lath nailed to joists with $1\frac{1}{2}$ in. barbed roofing nails, having $\frac{7}{16}$ in. heads and spaced $4\frac{3}{4}$ in. on centers. Plaster applied with sufficient pressure to form large keys on back of lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. vermiculite to 100 lbs. fibered gypsum. (58)	$1\frac{1}{2}$ hrs. comb.
	Wood floor consisting of 1 in. (nominal) tongue and groove sub and finish flooring with building paper between. Ceiling of $\frac{3}{4}$ in. gypsum-perlite plaster on metal lath nailed to joists with $1\frac{1}{2}$ in. barbed roofing nails having $\frac{7}{16}$ in. heads and spaced $4\frac{3}{4}$ in. on centers. Plaster applied with sufficient pressure to form large keys on back of lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. fibered gypsum. (57)	$1\frac{1}{2}$ hrs. comb.
	Wood floor consisting of 1 in. (nominal) tongue and groove sub and finish flooring with building paper between. Ceiling of $\frac{1}{2}$ in. gypsum-perlite plaster on $\frac{3}{8}$ in. perforated gypsum lath, nailed to joists with $1\frac{3}{16}$ in. nails having $\frac{9}{32}$ in. diameter heads. Plaster mix: scratch and brown coats $2\frac{1}{2}$ cu. ft. perlite to 100 lbs. fibered gypsum. (52)	1 hr. comb.
	Wood floor consisting of 1 in. (nominal) tongue and groove sub and finish flooring with building paper between. Ceiling of two layers $\frac{1}{2}$ in. gypsum wallboard with 1 in. mesh wire fabric between. First layer of wallboard nailed with $1\frac{5}{8}$ in. nails having $\frac{7}{32}$ in. heads; wire fabric and second layer of wallboard nailed with $2\frac{3}{8}$ in. nails having $\frac{1}{4}$ in. heads. Outside joints taped and pointed; nailheads covered with joint cement. (53)	1 hr. comb.
	Wood floor consisting of 1 in. (nominal) tongue and groove sub and finish flooring with building paper between. Ceiling of $\frac{5}{8}$ in. U.L. listed wallboard nailed with $1\frac{7}{8}$ in. nails, 6 in. on centers. Joints covered with fiber tape and joint finisher. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 1-1 HR.	1 hr. comb.
	Wood floor consisting of $\frac{3}{4}$ in. sub-floor and tongue and groove finish flooring with asbestos paper weighing 12 to 14 lbs. per 100 sq. ft. between. Ceiling of $\frac{1}{2}$ in. 1:2 gypsum and sand plaster on $\frac{3}{8}$ in. perforated gypsum lath attached by $1\frac{1}{2}$ in. nails with $\frac{3}{8}$ in. heads and spaced 4 in. on centers; 3 in. strips of expanded metal lath nailed over all joints in gypsum lath using $1\frac{3}{4}$ in. nails with $\frac{1}{2}$ in. heads spaced 5 in. on centers along joists and with 2 nails to each joist for joints perpendicular to joists. (9)	1 hr. comb.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Wood Joists	Double $\frac{7}{8}$ in. tongue and groove wood flooring with insulating layer between. Ceiling of $\frac{1}{2}$ in. 2:1 wood-fibered gypsum and sand plaster on $\frac{3}{8}$ in. plain gypsum plaster base attached by $1\frac{1}{4}$ in. nails with $\frac{7}{16}$ in. heads, 12 to each 16 x 48 in. lath; 3 in. strips expanded metal lath nailed over all joints in gypsum lath. (25)	1 hr. comb.
	Wood floor consisting of $\frac{3}{4}$ in. sub-floor and tongue and groove finish flooring with asbestos paper weighing 12 to 14 lbs. per 100 sq. ft. between. Ceiling of $\frac{3}{4}$ in. 1:2, 1:3 gypsum and sand plaster on metal lath nailed with $1\frac{1}{2}$ in. No. 11 gauge barbed roofers' nails having $\frac{7}{16}$ in. heads and spaced 6 in. on centers. (9)	1 hr. comb.
	Wood floor consisting of $\frac{3}{4}$ in. sub-floor and tongue and groove finish flooring with two layers of kraft paper with tar between weighing 5.6 lbs. per 100 sq. ft. between sub and finish flooring. Ceiling of $\frac{3}{4}$ in. 1:2, 1:3 portland cement and sand plaster with 3 lb. asbestos fiber and 15 lbs. hydrated lime added per 94-lb. bag of cement, on metal lath nailed with $1\frac{1}{2}$ in. No. 11 gauge barbed roofers' nails having $\frac{7}{16}$ in. heads and spaced 6 in. on centers. (9)	1 hr. comb.

Estimated Ratings

Brick Arch	Minimum depth 4 in. for spans of 5 ft. or less; rise at least 1 in. per ft. of span; at least 2 in. concrete fill on top of arch; ceiling plastered with $\frac{3}{4}$ in. portland cement or gypsum plaster (23)	3 hrs.
	Minimum depth 8 in.; rise at least 1 in. per ft. of span. (23)	3 hrs.
Hollow Clay Tile Arch	Minimum depth 6 in. with at least 2 cells in the depth; shells and webs not less than $\frac{5}{8}$ in. in thickness; vertical and horizontal dimension of cells not greater than 4 in.; at least 2 in. concrete fill on top of arch; ceiling plastered with $\frac{3}{4}$ in. portland cement or gypsum plaster. (24)	3 hrs.
Reinforced Concrete Joists (Not over 30 in. on centers)	$2\frac{1}{2}$ in. reinforced ^w concrete floor slab on joists. Ceiling of 1 in. unsanded, wood-fibered gypsum plaster, or $\frac{3}{4}$ in. gypsum-perlite or gypsum-vermiculite plaster on metal lath. Plaster mix: scratch coat 2 to $2\frac{1}{2}$ cu. ft. and brown coat 3 to $3\frac{1}{2}$ cu. ft. perlite or vermiculite to 100 lbs. gypsum.	3 hrs.
	$2\frac{1}{4}$ in. reinforced ^w concrete floor slab on joists. Ceiling of $\frac{3}{4}$ in. 1:2, 1:3 gypsum and sand plaster on metal lath.	2 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

FLOOR AND CEILING CONSTRUCTIONS—Continued

Estimated Ratings

Type	Details of Construction	Rating
Steel Joists (Fabricated from Rolled Sections or from Strip or Sheet Steel) or Steel Beams ^u	2½ in. concrete or gypsum slab on metal lath. Ceiling of ⅞ in. 1:2 gypsum and sand plaster on metal or wire lath.	2½ hrs.

ROOF CONSTRUCTIONS

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Gypsum Slab	2 in. reinforced gypsum concrete on ½ in. gypsum form- board supported on bulb-T rails 32 ⅜ in. on centers (106)	1 hr.
Steel Units, ^u Corrugated	3½ in. reinforced perlite concrete on steel form units. Concrete mix: 6 cu. ft. of U.L. listed perlite aggre- gate to 94 lbs. of portland cement and 1½ pints of air entraining agent. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Con- structions—Design No. 6-1 HR.	1 hr.
Steel Units, ^u Ribbed	3 in. U.L. listed reinforced vermiculite concrete on ribbed steel floor units. Other details as specified in U.L. listings, under Floor or Roof, and Ceiling Constructions—Design No. 1-1½ HR.	1½ hrs.
Any construction described under "Floor and Ceiling Constructions."		Same as Floor Rating

Letter superscripts refer to notes, page 55.

WALLS AND PARTITIONS Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Combustible Members Framed in Wall ^a			Members Framed in Wall: None or Noncombustible		
		Minimum Thickness ^b , Inches for Ratings of			Minimum Thickness ^b , Inches for Ratings of		
		4 hrs.	3 hrs.	2 hrs.	1 hr.	4 hrs.	3 hrs. 2 hrs. 1 hr.
Brick (clay, shale, concrete or sand-lime)	Solid walls plastered one side or unplastered. (1, 2, 3, 93)	12	12	8	8	8	8 8 4
	Solid walls plastered each side with $\frac{1}{2}$ in. 1:3 gypsum and sand or portland cement and sand plaster, or $\frac{5}{8}$ in. 1:2½ portland cement and sand or lime and sand plaster. (1, 2, 3, 93)	12	8	8	8	8	4 4 4
	Hollow "Cavity" type walls; $\frac{1}{4}$ in. round metal ties spaced 2 ft. horizontally every 6th course. (9, 93)	—	—	—	d 10	10	10 10 10
	.....	U=units	U=units	U=units	U=units	See Note g	
Hollow Tiles (clay or shale) Load bearing	Unplastered. (4)	16 ^{2U} _{4C}	16 ^{2U} _{4C}	12 ^{3C}	12 ^{3C}	12 ^{2U} _{4C}	12 ^{2U} _{4C} 12 ^{3C} 8 _{2C}
	Plastered one side ¹ with $\frac{5}{8}$ in. 1:3 gypsum and sand plaster. (4)	16 ^{2U} _{4C}	12 ^{3C}	12 ^{2C}	8 _{2C}	12 ^{2U} _{4C}	12 ^{2U} _{4C} 12 ^{3C} 8 _{2C}
	Plastered each side as above. (4)	16 ^{2U} _{4C}	12 ^{3C}	12 ^{2C}	8 _{2C}	12 ^{2U} _{4C}	12 ^{2U} _{4C} 12 ^{3C} 8 _{2C}
	.....	U=units	U=units	U=units	U=units	See Note g	
Hollow Tile, Brick-faced	Hollow clay (or shale) load-bearing tile of thickness shown, bonded to 4 in. brick facing, unplastered. (9)	—	—	8	4	8	4 4 4
	Same as above with tile side plastered with $\frac{5}{8}$ in. 1:3 gypsum and sand plaster. (4, 9)	—	12	8	4	4	4 4 4

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Brick (Cored)	6 in. units 76% solid, unplastered; with noncombustible or no members framed into the wall. (91)	2½ hrs.
Brick (Hollow)	8 in. units 42% solid, plaster on both sides with ⅝ in. 1:3 gypsum and sand plaster: (64) With noncombustible or no members framed into wall.	4 hrs.
	With combustible framed ^a in members fully embedded in mortar.	3 hrs.
	With unembedded combustible members framed ^a into wall.	2 hrs.
	8 in. units 42% solid, unplastered: (64) With noncombustible or no members framed into wall.	3 hrs.
	With combustible framed ^a in members fully embedded in mortar.	2 hrs.
	With unembedded combustible members framed ^a into wall.	1½ hrs.
Clay Tile	8-in. wall constructed of U.L. listed clay tile. Regular courses made with 3¾ in. thick units; bonding course made with 1¾ and 5¾ in. thick units located every fourth course, with wide and narrow tile alternated on opposite faces. Other details as specified in U.L. listing ^c under Walls and Partitions—Design No. 3-3 HR.	3 hrs.*
	6⅜ in. partition with two units in wall thickness, one unit 3⅞ in., other 1¾ in. thick, with ¾ in. joint between filled with mortar. Position of units reversed on alternating courses. Tile cored not to exceed 25% in 4 in. unit, and not to exceed 15% in 1¾ in. unit. (13)	3 hrs.*
	6 in. partition consisting of 4 in. tile cored not to exceed 41%, faced on fire exposed side with 1¾ in. tile cored not to exceed 15% with ¾ in. mortar filled joint between, and plastered on opposite side with ¾ in. 1:3 gypsum and sand plaster. (12)	3 hrs.*
	4 in. facing tile cored not to exceed 25%, plastered on back side with ¾ in. 1:3 gypsum and sand plaster. (14)	2 hrs.*
	4 in. facing tile cored not to exceed 30%, plastered on back side with ¾ in. gypsum-vermiculite plaster composed of 3½ cu. ft. vermiculite to 100 lbs. gypsum. (16)	2 hrs.*
	4 in. hollow tile of medium burned clay, not less than 60% solid, two cells in thickness; both sides plastered with ⅝ in. 1:3 gypsum and sand plaster. (9, 59)	2 hrs.*

* Nonbearing.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Clay Tile	6 in. hollow tile of medium burned clay, not less than 45% solid, two cells in thickness; both sides plastered with $\frac{5}{8}$ in. 1:3 gypsum and sand plaster. (9, 59).....	2 hrs.*
	6 in. hollow tile of medium burned clay, not less than 30% solid; plastered on both sides with $\frac{5}{8}$ in. 1:3 gypsum and sand plaster. (9, 59)	1½ hrs.*
	3 in. hollow tile not less than 50% solid, or 4 in. hollow tile not less than 40% solid, of medium burned clay; plastered on both sides with $\frac{5}{8}$ in. 1:3 gypsum and sand plaster. (9, 59)	1 hr.*
	4 in. facing tile cored not to exceed 47%, plastered on back side with $\frac{3}{4}$ in. 1:3 gypsum and sand plaster. (30)	1 hr.*
	4 in. hollow tile plastered each side with $\frac{3}{4}$ in. 1:3 gypsum and sand plaster. (5)	1 hr.*
	6 in. hollow tile plastered each side with $\frac{5}{8}$ in. 1:3 gypsum and sand plaster. (9).....	1 hr.*
	4 in. hollow tile having 2 cells in wall thickness plastered each side with $\frac{5}{8}$ in. 1:3 gypsum and sand plaster. (9)	1 hr.*
Composite Blocks	8 in. solid blocks of autoclaved cellular concrete consisting of portland cement, sand and powdered aluminum with blocks having a density of 31 lbs. per cu. ft. (111)	4 hrs.
	4½ in. wall consisting of 3 in. U.L. listed building units, plastered on both sides with $\frac{3}{4}$ in. 1:1, 1:2 gypsum sand plaster. Mortar joints and other details as specified in U.L. listing ^c under Walls and Partitions—Design No. 2-3 HR.	3 hrs.*
	4½ in. wall consisting of 3 in. U.L. listed building units, (tongue and groove joints—without mortar but with 4 in. strips of metal lath nailed over joints), plastered on both sides with $\frac{3}{4}$ in. plaster. Scratch and brown coats 3 cu. ft. U.L. listed perlite plaster aggregate to 100 lbs. fibered gypsum. Other details as specified in U.L. listing ^c under Walls and Partitions—Design No. 4-3 HR.	3 hrs.*
	4½ in. partition consisting of 3 in. thick U.L. listed building units. $\frac{3}{4}$ in. gypsum perlite plaster on both sides. Plaster mix: scratch and brown coat 2 cu. ft. and 3 cu. ft. U.L. listed perlite aggregate to 100 lbs. of fibered gypsum. Building units laid as specified in U.L. listings ^c , under Walls and Partitions—Design No. 6-3 HR.	3 hrs.*
	3 in. blocks of shredded wood bound with magnesium oxysulfate cement, plastered each side with $\frac{1}{2}$ in. 1:3 gypsum and sand plaster. (9)	2 hrs.*
	2 in. blocks as above, plastered as above. (9).....	1 hr.*
	3 in. partition consisting of 2 in. thick U.L. listed building units attached to fir plywood splines. Joints filled flush with joint cement and covered with 6 in. wide paper and metal lath strips. $\frac{1}{2}$ in. 1:2½ gypsum and sand plaster applied to each face of building units. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 13-1 HR.	1 hr.* comb.

* Nonbearing.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Composite Blocks with Brick Veneer	9½ in. wall consisting of 3 in. cement coated wood fiber composite units spaced 2¼ in. from 3¾ in. brick. Composite units plastered one side with ½ in. 1:2 gypsum and sand plaster. Two wythes bonded together by ½ in. diameter zinc alloy rods shaped as "Z" anchors and spaced 18½ in. vertically and 24 in. horizontally. (104)	4 hrs.*
Concrete Masonry Units	8 or 12 in. U.L. listed concrete blocks, laid as specified in U.L. listing ^c , under Walls and Partitions—Design No. 1-4 HR.	4 hrs.†
	8 or 12 in. U.L. listed concrete blocks; cells filled with loose, dry expanded slag, burned clay or shale (Rotary Kiln Process) and laid as specified in U.L. listing ^c , under Walls and Partitions—Design No. 1-3 HR or No. 1-2 HR.	4 hrs.†
	4 in. U.L. listed concrete blocks; cells filled with perlite mortar and laid as specified in U.L. listing ^c , under Walls and Partitions—Design No. 2-4 HR.	4 hrs.*
	8 or 12 in. U.L. listed concrete blocks, laid as specified in U.L. listing ^c , under Walls and Partitions—Design No. 1-3 HR.	3 hrs.†
	8 or 12 in. U.L. listed concrete blocks, laid as specified in U.L. listing ^c , under Walls and Partitions—Design No. 1-2 HR.	2 hrs.†
	8 or 12 in. U.L. listed concrete blocks with combustible members framed in wall, and plastered on face opposite framing with ¾ in. portland cement stucco or gypsum plaster; laid as specified in U.L. listing ^c , under Walls and Partitions—Design No. 1-4 HR, No. 1-3 HR, or No. 1-2 HR.	1½ hrs.
	8 or 12 in. U.L. listed concrete blocks with combustible members framed in wall; laid as specified in U.L. listing ^c , under Walls and Partitions—Design No. 1-4 HR or No. 1-3 HR or No. 1-2 HR.	1 hr.

* Nonbearing. † Rated as load bearing with noncombustible or no members framed into wall.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Type of Aggregate	Minimum Face Shell and Web Thicknesses, Inches.‡					
		2 hrs.†		3 hrs.†		4 hrs.†	
		Face	Web	Face	Web	Face	Web
Concrete	Natural, by-product, and proc-						
Masonry	essed, except those listed be-						
Units	low. (96)	1¼	1	1½	1	2⅛	1½
(8 or 12	Burned clay or shale. (96)	1⅛	1	1¾	1		
in. units)	Expanded slag. (96)	1⅛	1	1¾	1	1⅝	1
	Pumice. (96)					1¼	1

Type	Type of Aggregate	Minimum Equivalent Thickness and Approximate Face Shell Thickness, Inches.§					
		2 hrs.†		3 hrs.†		4 hrs.†	
		Face Shell Thick-ness	Equiv-alent Thick-ness	Face Shell Thick-ness	Equiv-alent Thick-ness	Face Shell Thick-ness	Equiv-alent Thick-ness
Concrete	Burned clay or shale,						
Masonry	rotary Kiln process.						
Units ^{hh}	(96)	1¼	4.20	1½	4.85	1¾	5.35
(8 or 12 in. units)							

* Nonbearing. † Rated as load bearing with noncombustible or no members framed into wall.

§ The minimum face shell for the largest core hole at the thinnest point (this may be the average of the two face shells in the same core). The end and internal webs in each core hole to be measured at the thinnest point.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Concrete Masonry Units	Expanded Shale Aggregate.	
	10 in. units 60% solid; unplastered. (9, 60).....	4 hrs.†
	8 in. units, minimum face shell thickness 1½ in., minimum end shell thickness 15/16 in. and minimum interior web thickness 3 1/16 in., unplastered. Concrete studs built into wall on 2 ft. centers by filling every third cell along the length of the wall. Each stud reinforced with one ½ in. round bar. (74)	2 hrs.*
	4 in. units 76% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster. (60).....	2 hrs.*
	6 in. units 61% solid; unplastered. (9, 60).....	1½ hrs.*
	3 in. units 76% solid; plastered on both sides with ½ in. 1:3 gypsum and sand plaster. (9, 60).....	1½ hrs.*
	Expanded Slag Aggregate.	
	10 in. unplastered cavity wall of two 4 in. wythes 2 in. apart; units 63% solid. (9, 60)	4 hrs.‡
	6 in. units 76% solid; unplastered. (9, 60).....	3 hrs.†
	6 in. units 61% solid; unplastered. (9, 60).....	2 hrs.*
	6 in. units 50% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster. (9, 60).....	2 hrs.*
	4 in. units 76% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster. (9, 60).....	2 hrs.*
	3 in. units 76% solid; plastered on both sides with ½ in. 1:3 gypsum and sand plaster. (9, 60).....	2 hrs.*
	4 in. units 63% solid; plastered on one side with ½ in. 1:3 gypsum sand and plaster. (9, 60).....	1½ hrs.*
	4 in. units 63% solid; unplastered. (9, 60).....	1 hr.*
	Pumice Aggregate.	
	10 in. units 60% solid; unplastered. (60).....	4 hrs.†
	4 in. units 63% solid; unplastered. (9, 60)	1 hr.*
	Calcareous Gravel Aggregate.	
	8 in. unplastered units, 78% solid. (61).....	3 hrs.†
	8 in. unplastered units, 57% solid. (61).....	2 hrs.†
	4 in. units 63% solid; plastered on both sides with ½ in. 1:3 gypsum and sand plaster. (9, 61).....	1½ hrs.*
	10 in. unplastered cavity wall of two 4 in. wythes 2 in. apart; units 63% solid. (9, 61).....	1 hr.†

* Nonbearing. † Rated as load bearing with noncombustible or no members framed into wall.

‡ With combustible members framed^a into the wall, the rating is 2 hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Concrete Masonry Units	Cinder Aggregate.	
	10 in. unplastered cavity wall of two 4 in. wythes 2 in. apart; units 63% solid. (9, 60).....	3 hrs.†
	6 in. units 61% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster. (9, 60).....	2 hrs.*
	6 in. units 50% solid; plastered on both sides with ½ in. 1:3 gypsum and sand plaster. (9, 60).....	2 hrs.*
	6 in. units unplastered, 61% solid. (9, 60).....	1½ hrs.*
	Siliceous Gravel Aggregate.	
	12 in. unplastered wall, consisting of 8 in. units 57% solid and 4 in. units 67% solid. (9, 61).....	4 hrs.†
	12 in. units 58% solid; plastered both sides with ½ in. 1:3 gypsum and sand plaster. (61).....	4 hrs.§
	4 in. units 74% solid; plastered on both sides with ½ in. 1:3 gypsum and sand plaster. (9, 61).....	1 hr.*
Concrete Masonry Units, Brick-faced	Expanded Shale Aggregate.	
	6 in. units 61% solid; unplastered; faced with 2¼ in. brick. (9, 60).....	4 hrs.†
	Expanded Slag Aggregate.	
	4 in. units 63% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster; other side faced with 3¾ in. brick. (9, 60).....	4 hrs.†
	Pumice Aggregate.	
	4 in. U.L. listed concrete blocks, alternate courses reinforced; unplastered; faced with 4 in. brick. 1 in. air space between block and brick. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 7-4 HR.	4 hrs.†
	Cinder Aggregate.	
	4 in. units 63% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster; other side faced with 3¾ in. brick. (9, 60).....	4 hrs.†
	6 in. unplastered units, 61% solid; faced with 2¼ in. brick. (60).....	4 hrs.†
Gypsum Block Partitions	4 in. hollow blocks plastered each side with ½ in. 1:3 gypsum and sand plaster. (6, 83).....	4 hrs.*
	3 in. hollow blocks plastered each side as above. (6, 82).....	3 hrs.*
	3 in. solid blocks, unplastered. (6).....	3 hrs.*
	4 in. hollow blocks plastered on either side with ½ in. 1:3 gypsum and sand plaster. (45, 89).....	3 hrs.*
	3 in. hollow blocks plastered on one side with ½ in. 1:3 gypsum and sand plaster. (44).....	1½ hrs.*
	2 in. solid blocks, unplastered. (6, 9).....	1 hr.*
	3 in. hollow blocks, unplastered. (9).....	1 hr.*

* Nonbearing. † Rated as load bearing with noncombustible, or no members, framed into the wall.

‡ With combustible members framed^a into the wall, the rating is 2 hrs.

§ With combustible members framed^a into the wall, the rating is 2½ hrs.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Gypsum Plank Partitions	3 in. gypsum plank with tongue and groove joints grouted with gypsum, surfaced one side with 20 gauge corrugated steel panels bolted to gypsum at top and bottom with ½ in. bolts 6 in. on centers. Plank made with 10 per cent wood sawdust, and reinforced with 2 in. wire mesh placed ½ in. from each face. (34).....	4 hrs.*
	4¼ in. gypsum plank with tongue and groove joints grouted with gypsum. Plank cast on 22 gauge corrugated (V beam) sheets which form one face. Plank made with 10 per cent wood sawdust, and reinforced with 4 in. wire mesh placed ½ in. from gypsum face. (35)	4 hrs.*
	2 in. gypsum planks with tongue and groove joints grouted with plaster. Planks cast on 22 gauge galvanized sheets which form one face, and made with 10% wood sawdust, reinforced with 4 in. wire mesh placed ½ in. from gypsum face. (68).....	1 hr.*
Gypsum Wallboard Partitions	5 in. thick wall consisting of two layers of ⅝ in. U.L. listed wallboard nailed each side of 1 in. wood runner strips spaced ½ in. apart at floor, ceiling and edges. Wallboard reinforced by vertical wallboard ribs 6¼ and 3¼ in. wide consisting of two layers of ½ in. gypsum wallboard glued together. Outside layers of wallboard attached to ribs with glue, wood screws and finishing nails. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 5-3 HR.	§§3 hrs.* comb.
	4 in. thick wall consisting of two layers of ⅝ in. U.L. listed gypsum wallboard nailed each side of 1½ in. wood runner strips at floor, ceiling and edges. Wallboard reinforced by vertical wallboard ribs 6¼ in. and 3¼ in. wide consisting of two layers of ½ in. gypsum wallboard glued together. Outside layers of wallboard attached to ribs with glue, wood screws and finishing nails. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 7-2 HR.	§§2 hrs.* comb.
	2¼ in. wall consisting of ⅝ in. U.L. listed wallboard ^c on two ½ in. gypsum wallboard ribs glued together with U.L. listed adhesive to form 6¼ in. wide joint ribs and 3¼ in. wide center ribs. Wallboard attached to ribs with U.L. listed adhesive and 2 in. nails spaced 6 in. on centers; 1½ in. wood screws spaced 20 in. on centers at joints. Joints, nail and screw heads taped and finished. Wall secured to 1 in. by 1⅝ in. wood runners at floor, wall and ceiling. Other details as specified in U.L. listing ^c , under Wall and Partitions—Design No. 10-1 HR.	§§1 hr.* comb.
Monolithic Cement	8 in. monolithic wall reinforced as specified in U.L. listing ^c , under Walls and Partitions—Design No. 4-4 HR and as described in detail in U.L. report R 3208 dated July 2, 1951.	4 hrs.†

* Nonbearing.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Partition Panel Units	6 in. wall consisting of U.L. listed steel building units each side of vermiculite concrete reinforced by U.L. listed steel frame. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 10-4 HR.	4 hrs.†
	5½ in. wall consisting of five layers of ½ in. U.L. listed gypsum wallboard ^{cc} . Wallboard attached to U.L. listed steel facing units by U.L. listed impaling clips welded to facing units. Wall reinforced with horizontal steel bar subgirts at impaling clips. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 7-3 HR.	3 hrs.*
	5 in. wall consisting of four layers of ½ in. gypsum wallboard ^{cc} applied so that joints in adjacent layers are staggered. 1½ in. 18 gauge fluted metal facing sheets with tongue and groove, applied each side of core, and bolted together with ¼ in. by 2¾ in. long bolts. Wall secured to steel angles at floor, wall and ceiling with ¼ in. by 2¾ in. long bolts. (100)	2½ hrs.*
	5½ in. wall consisting of four layers of ½-in. U.L. listed gypsum wallboard ^{cc} . Joints in four layers of wallboard staggered and spiked together and secured to U.L. listed steel face units. ¼ in. diameter by 3 in. long bolts spaced 4 ft. on centers through wallboard and attached to steel facing units. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 10-2 HR.	2 hrs.*
	5¾ in. wall consisting of five layers of ½ in. U.L. listed gypsum wallboard ^{cc} faced with U.L. listed steel facing units on one side and U.L. listed aluminum facing units on the other. Wallboard attached to steel facing units by U.L. listed impaling clips. Wall reinforced by horizontal and vertical steel bar subgirts. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 9-2 HR.	2 hrs.*
	5 3/16 in. wall consisting of four layers of ½ in. U.L. listed wallboard ^{cc} , faced each side with U.L. listed steel facing units. Wall reinforced with steel bar subgirt spaced not more than 48 in. on centers vertically. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 8-2 HR.	2 hrs.*
	3½ in. (minimum thickness) U.L. listed sprayed fiber applied to reinforced side of corrugated steel wall units and reinforcing. Corrugated wall units of No. 26 USS gage galvanized steel reinforced horizontally at top and center of wall with No. 14 USS gage steel. Reinforcing tied together with ½ in. diameter steel rods spaced 5 ft. on centers horizontally. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 12-1 HR.	1 hr.*
	3¾ in. wall composed of U.L. listed rockwool lined steel panels and a middle layer of ¾ in. U.L. listed asbestos cement boards, secured to steel channels at floor, wall and ceiling. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 8-1 HR.	1 hr.*

* Nonbearing.

† Load not to exceed 8,910 lbs. per stud.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Precast Concrete Wall Sections	8 in. hollow units of expanded slag concrete, 52% solid, minimum wall and web thicknesses 1½ in., unplastered. Units laid vertically on lintel with flange of ring anchors in center groove of units at the joints on the lintel. 3 in. paper tubing set on top of ring anchors and pressed into joint. Joints grouted to paper tubing. ¾ in. horizontal reinforcing rod inserted through the exposed section of ring anchors and tied in place. Floor strap anchors tied to reinforcing rod. All steel covered with concrete. (98)	4 hrs.
	6 in. U.L. listed precast concrete units; cells filled with grout; joints and top 6 in. of units reinforced and installed as specified in U.L. listing ^c , under Walls and Partitions—Design No. 9-4 HR.	4 hrs.
	6 in. solid plank of autoclaved cellular concrete consisting of portland cement, sand and powdered aluminum with planks having a density of 31 lbs. per cu. ft. Grout consisting of 1 to 3 (by volume) portland cement and sand poured into vertical grooves of block locking planks together. (112)	4 hrs.
	6 in. hollow panels of pumice concrete; core holes 3⅝ in. to 3⅞ in., face shell thickness 1 in. to 1¼ in. Panels held in alignment and secured together by removing top 5 in. of webs in each panel, and core holes, joints and top 5 in. filled with 1:5.33 cement sand grout. Joints and top of panels reinforced with ½ in. reinforcing bar. (101)	4 hrs.*
	6 in. U.L. listed concrete units; cells and spaces completely filled with fluid mortar mix and construction reinforced with ½ in. deformed steel spaced 24 in. on centers horizontally and vertically. Mortar mix: 5 cu. ft. pumice aggregate and 1 cu. ft. of cement. Other details as specified in U.L. listing ^c under Walls and Partitions—Design No. 8-4HR	4 hrs.†
	2 in. precast concrete slabs of expanded shale aggregate, 16 in. by 8 ft. laid horizontally and attached each side of 8 in. steel columns spaced on 8 ft. centers. Horizontal joints shiplap type, sealed with mastic. Vertical joints butt type centered over columns and calked with asbestos wicking and sealed with mastic. (77)	2½ hrs.*
	6 in. U.L. listed precast concrete units; joints and top 6 in. of cells in units reinforced and filled with grout and installed as specified in U.L. listing ^c , under Walls and Partitions—Design No. 6-2 HR.	2 hrs.
	6⅞ in. solid wall composed of 1:4 portland cement and perlite concrete aggregate mixture, applied with spray gun equipment to paper-backed wire fabric, and reinforced with 16 gauge 2 in. by 2 in. welded wire mesh fastened to 3⅝ in. steel channel studs. (115)	4 hrs.
	4¼ in. solid wall composed of 1 cu. ft. portland cement to 4 cu. ft. U.L. listed vermiculite plaster aggregate, applied with spray machine equipment to paper-backed wire fabric. Wall reinforced with 1½ in. steel channel studs 2 ft. on centers and spaced 1¾ in. from paper-backed wire fabric. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 6-5 HR.	4 hrs.*
Portland Cement and Aggregate Spray Machine Applied (With steel framing)		

* Nonbearing.

† Rated as load bearing with noncombustible or no members framed into wall. Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Portland Cement and Aggregate Spray Machine Applied (With steel framing)	6 in. solid wall composed of 1:4 portland cement and sand mixture, applied with spray gun equipment. Wall reinforced with $\frac{1}{2}$ in. round bars on 12 in. centers each way at the mid-thickness of the wall. (72) 2½ in. total thickness of 4½:1:7 portland cement, sawdust and sand mortar sprayed on 4 in. by 4 in. welded wire fabric on steel studs. (9)	3 hrs.* 1 hr.*
Solid Gypsum Board Partitions (Without steel framing)	2 in. total thickness consisting of 1 in. U.L. listed interlocking laminated gypsum coreboard placed vertically and set in floor and ceiling runners made of 20 gauge sheet metal. $\frac{1}{2}$ in. U.L. listed wallboard ^c applied to the coreboard vertically and secured to the coreboard by an adhesive coating. Wallboard joints butted and staggered with joints of coreboard. Outside joints covered with tape and joint finisher. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 3-2 HR. 1¾ in. minimum total thickness consisting of 1 in. U.L. listed laminated gypsum coreboard erected vertically and set in floor and ceiling runners made of 20 gauge sheet metal. Vertical joints of coreboard butted and held with steel tee clips. Outer layer of $\frac{3}{8}$ in. or $\frac{1}{2}$ in. U.L. listed wallboard applied vertically or horizontally and secured to adhesive coated coreboard. Vertical joints in wallboard butted and staggered with joints of coreboard. Outside joints covered with tape and joint finisher. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 9-1 HR.	2 hrs.* 1 hr.*
Solid Plaster Partitions (Steel framing embedded in plaster)	2½ in. total thickness of neat gypsum plaster on metal lath attached to $\frac{3}{4}$ in. or 1 in. steel channels. (9) 2½ in. total thickness of gypsum-perlite plaster, on metal lath attached to $\frac{3}{4}$ in. steel channels. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite plaster aggregate to 100 lbs. fibered gypsum. Other details as specified in U.L. listing ^c under Walls and Partitions—Design No. 2-2 HR. 2½ in. total thickness of gypsum-vermiculite plaster on metal lath attached to $\frac{3}{4}$ in. steel channels. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. of vermiculite to 100 lbs. gypsum. (79) 2 in. total thickness of unsanded, wood-fibered gypsum plaster on metal lath on steel studs. (94) 2½ in. total thickness of 1:½, 1:½ gypsum and sand plaster on metal lath on steel studs. (9) 2 in. total thickness of 1:½, 1:½ gypsum and sand plaster on metal lath attached to $\frac{3}{4}$ in. or 1 in. steel channels. (9) 1½ in. gypsum-perlite plaster on metal lath attached to $\frac{3}{4}$ in. steel channels. Plaster mix for scratch and brown coats 2½ cu. ft. perlite to 100 lbs. fibered gypsum. (66)	2½ hrs.* 2 hrs.* 2 hrs.* 2 hrs.* 2 hrs.* 1½ hrs.* 1 hr.*

* Nonbearing.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Plaster Partitions (Steel framing; embedded in plaster) Solid	2¼ in. total thickness of ¾ in. plaster of 86 parts gypsum, 12 parts sawdust and 2 parts asbestos fiber each side ¾ in. asbestos lath (medium), with sheet-steel H supports. (7).....	1 hr.*
	2½ in. total thickness of 1:2, 1:3 gypsum and sand plaster on metal lath on steel studs. (7, 9).....	1 hr.*
	2 in. total thickness of 1:2, 1:2 gypsum and sand plaster on metal lath on steel studs. (40).....	1 hr.*
	2⅝ in. total thickness of ⅞ in. 1:1 gypsum and sand plaster each side of ⅜ in. gypsum lath; steel stud supports. (15)	1 hr.*
	2½ in. total thickness of ¾ in. 1:2½ gypsum and sand plaster each side 1 in. board of shredded wood bound with magnesium oxysulfate cement, with sheet steel H supports. (7, 9).....	1 hr.*
	2 in. total thickness of 1:1 gypsum and sand plaster on metal lath on steel studs. (9).....	1 hr.*
Solid Plaster Partitions (Without steel framing)	2½ in. total thickness consisting of ½ in. gypsum lath, faced on both sides with 1 in. gypsum-vermiculite plaster. Scratch coat 2 cu. ft. and brown coat 3 cu. ft. vermiculite to 100 lbs. fibered gypsum. (79)	2 hrs.*
	2 in. total thickness consisting of ½ in. gypsum lath, faced on both sides with ¾ in. gypsum-perlite plaster. Scratch coat 2 cu. ft. and brown coat 3 cu. ft. of perlite to 100 lbs. gypsum. (63).....	1½ hrs.*
	2 in. total thickness consisting of ½ in. gypsum lath, faced on both sides with ¾ in. gypsum and sand plaster. Top of lath attached to steel ceiling runner, and bottom engaged in groove of a wooden floor runner impregnated with fire retardant chemicals. Plaster mix for scratch coat 1:1 and brown coat 1:2 gypsum and sand. (54)	881 hr.* comb.
	2 in. total thickness of 1:2 gypsum and sand plaster, applied equally each side of metal lath attached top and bottom to steel runners. (67).....	1 hr.*
	2 in. total thickness consisting of ½ in. U.L. listed gypsum lath, faced on both sides with ¾ in. 1:1 gypsum and sand plaster. Lath set into steel channels at floor, ceiling and abutting walls, as specified in U.L. listings under Walls and Partitions—Design No. 4-1 HR.	1 hr.*
	2 in. total thickness of 13/16 in. 1:1, 1:2 gypsum and sand plaster each side ⅝ in. gypsum lath inserted at top and bottom in steel runners. (37)	1 hr.*
	2 in. total thickness of ¾ in. 1:1, 1:2 gypsum and sand plaster each side ½ in. gypsum lath inserted at top and bottom in steel runners. (41).....	1 hr.*
	2 in. total thickness consisting of a 1 in. laminated core made up of two layers of ½ in. plain gypsum lath faced on both sides with ½ in. 1:2½ gypsum and sand plaster. Gypsum lath joined together by means of 8d common nails driven at angle through shiplap joints of lath. Top of lath wire tied to No. 24 gage steel ceiling runner strip and bottom of lath placed in metal base clips. (109)	1 hr.*

* Nonbearing.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Stud Brick-Veneered Walls²	One side sheathed with paper-backed wire lath and 3¾ in. brick veneer secured by filling 1 in. space between brick and lath with mortar. Other side faced with 1 in. paper-enclosed mineral-wool blanket weighing 0.6 lb. per sq. ft. attached to studs; metal lath laid over blanket and attached to studs, covered with ¾ in. 1:2, 1:3 gypsum and sand plaster. (9).....	4 hrs.
	One side with ½ in. gypsum sheathing nailed to 2 5/16 in. studs, and 3¾ in. brick veneer secured with metal ties to studs every fifth course. Other side ½ in. 1:2 gypsum and sand plaster on ½ in. perforated gypsum lath. (78).....	2 hrs.
	One side sheathed with 1 in. magnesium oxysulphate wood fiberboard attached to studs, 1 in. air space and 3¾ in. brick secured with metal ties to studs every fifth course. Other side faced with 7/8 in. gypsum-vermiculite plaster on metal lath secured directly to studs. (9)	2 hrs.
	One side sheathed with 1 in. magnesium oxysulphate wood fiber board attached to studs, 1 in. air space, and 3¾ in. brick secured with metal ties to studs every fifth course. Other side faced with 7/8 in. 1:2 gypsum and sand plaster on metal lath secured directly to studs. (9)	1½ hrs.
	One side sheathed with ½ in. wood fiberboard sheathing next to studs; ¾ in. air space formed with ¾ in. by 1½ in. wood strips placed over the fiberboard and secured to the studs; paper-backed wire lath nailed to these strips, 3¾ in. brick veneer held in place by filling ¾ in. space between brick and paper-backed lath with mortar. Inside facing of ¾ in. neat gypsum plaster on metal lath attached to 5/16 in. wood strips secured to edges of the studs. (9)	1½ hrs. comb.
Steel Stud Hollow Partitions, Plastered Finished each side as noted	7/8 in. unsanded, wood-fibered gypsum plaster on metal lath. (7, 9)	2 hrs.*
	1 in. 1:½, 1:½ gypsum and sand plaster on metal lath. (9)	2 hrs.*
	1 in. unsanded, wood-fibered gypsum plaster on metal lath. (7, 9)	2 hrs.†
	1½ in. gypsum-perlite plaster on metal lath attached to 4 in. studs, and sufficient plaster pushed through the lath to give an average total thickness of 1½ in. Plaster mix for scratch and brown coats, 100 lbs. fibered gypsum to 3.7 cu. ft. perlite. (70)	2 hrs.*
	1½ in. gypsum-perlite plaster on metal lath attached to 4 in. studs, and sufficient plaster pushed through the lath to give an average total thickness of 1½ in. Plaster mix for scratch and brown coats, 100 lbs. fibered gypsum to 4 cu. ft. perlite. (71).....	2 hrs.*
	1 in. gypsum-perlite plaster on metal lath attached to 4 in. studs, and sufficient plaster pushed through the lath to give an average total thickness of 1¾ in. Plaster mix for scratch and brown coats, 100 lbs. fibered gypsum to 3.75 cu. ft. perlite. (73).....	2 hrs.*

* Nonbearing. † For partitions loaded not to exceed 5,120 lbs. per sq. in. of stud area the rating is 2½ hrs.

Letter superscripts refer to notes, page 55

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Stud Hollow Partitions, Plastered Finished each side as noted	1 in. (measured from face of lath) gypsum-perlite plaster, on metal lath attached to 4 in. studs. Plaster mix: scratch coat 2 cu. ft. and brown 3 cu. ft. of perlite to 100 lbs. fibered gypsum. (55)	2 hrs.*
	$\frac{3}{4}$ in. unsanded, wood-fibered gypsum plaster on metal lath. (7, 9)	1½ hrs.
	$\frac{7}{8}$ in. 1:½, 1:½ gypsum and sand plaster on metal lath. (9)	1½ hrs.*
	$\frac{1}{2}$ in. 1:2 gypsum and sand plaster on $\frac{3}{8}$ in. perforated gypsum lath, attached securely to 2½ in. studs by special clips across lath. Abutting ends of lath secured to each other with metal wire clips. Studs pressed into ceiling track and fastened with two double strands of tie-wires; attached to floor track with a double strand of wire ties each side of track. (102)	1½ hrs.*
	$\frac{1}{2}$ in. 1:2 gypsum and sand plaster on $\frac{3}{8}$ in. perforated gypsum lath, attached securely to 3¼ in. steel studs by metal clips across lath. Abutting ends of lath secured to each other with metal wire clips. Studs fastened to ceiling and floor tracks with two double strands of tie-wire at ceiling and floor. (103)	1½ hrs.*
	$\frac{1}{2}$ in. 1:2 gypsum and sand plaster on $\frac{3}{8}$ in. perforated gypsum lath attached securely to 2½ in. studs by tie wires and wire clips. Abutting ends of lath secured to each other with metal wire clips. Studs pressed into ceiling track and fastened with two double strands of tie wires attached to floor track with a double strand of wire ties on each side of track. (84)	1½ hrs.*
	$\frac{7}{8}$ in. 1:1/30:2, 1:1/30:3 portland cement, asbestos fiber and sand plaster on metal lath. (9)	1 hr.*
	$\frac{7}{8}$ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (7, 9)	1 hr.
	$\frac{3}{4}$ in. 1:2 portland cement and sand plaster in the scratch coat, 1:3 gypsum and sand plaster in the brown coat, on metal lath. (7)	1 hr.*
	$\frac{3}{4}$ in. 1:2, 1:2 gypsum and sand plaster on metal lath. (7, 9)	1 hr.
	3¼ in. wall (total thickness) consisting of ¾ in. gypsum and sand plaster on ½ in. gypsum lath attached tightly to ¾ in. channel frame by wire ties. ¾ in. channels spaced 30 in. on centers horizontally and 5 ft. on centers vertically; tied at intersections. Channel frame attached to ¾ in. runner channels at ceiling, floor and wall edge. Plaster mix: scratch coat 100 lbs., brown coat 200 lbs. sand to 100 lbs. fibered gypsum. (107)	1 hr.*
	$\frac{1}{2}$ in. 1:1 gypsum and sand plaster on ¾ in. gypsum lath on steel studs providing 1¼ in. central air space. (15)	1 hr.*
	$\frac{1}{2}$ in. 1:2 gypsum and sand plaster on ¾ in. perforated gypsum lath attached securely to 3¼ in. studs by metal clips, abutting ends of lath secured to each other with metal finger clips. (46)	1 hr.*

* Nonbearing.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Stud Hollow Partitions Without Plaster Finished each side as noted	½ in. gypsum-perlite plaster on ¾ in. perforated gypsum lath attached securely to 4 in. studs by metal clips and with abutting ends of lath secured to each other with metal finger clips. Plaster mix for scratch and brown coats, 100 lbs. gypsum to 2½ cu. ft. perlite. (48)	1 hr.*
	½ in. gypsum-perlite plaster on ¾ in. plain or perforated gypsum lath attached securely to 2½ in. studs by metal clips and with abutting ends of lath secured to each other with metal finger clips. Plaster mix: scratch and brown coats, 100 lbs. gypsum to 2½ cu. ft. perlite. (110, 114)	1 hr.*
	⅝ in. gypsum wallboard ^{cc} attached to 3⅝ in. steel studs, with 2 in. cement coated nails spaced about 7 in. on centers. Joints covered with fiber tape and cement. (87)	1 hr.
	⅝ in. U.L. listed gypsum wallboard ^{cc} attached to 3⅝ in. steel studs with 2½ in. nails spaced 8 in. on centers. Joints and nail heads covered with fiber tape and cement. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 2-1 HR.	1 hr.*
	½ in. cement-asbestos board on 3 in. steel studs; interior space filled with mineral wool under air pressure. (21)	1 hr.*
	⅝ in. U.L. listed gypsum wallboard ^{cc} attached to 3⅝ in. U.L. listed steel studs with 1½ in. annular nails spaced 6 in. on centers and used with ¾ in. nailing discs at wallboard joints. Studs attached to floor and ceiling track with plated No. 6, ¾ in. sheet metal screws. Nailheads in wallboard covered with joint cement and joints covered with fiber tape and cement. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 11-1 HR.	1 hr.*
	3⅞ in. wall composed of 7/16 in. thick pigmented asbestos board weighing 2.2 to 2.4 lbs. per sq. ft., on open web 20 gauge steel box studs. Space between studs packed solid with mineral wool batts. (85)	1 hr.*
Steel Stud Wall (Steel framing encased in plaster)	6 in. wall consisting of 4 in. perlite-portland cement plaster on paper-backed wire fabric and encasing steel framing members on one face; 1 in. gypsum-perlite plaster applied on paper and aluminum foil-backed wire fabric on other face, with furring channels forming 1 in. air space between the two sections. Plaster mix for 4 in. face, 4 cu. ft. U.L. listed perlite to 94 lbs. portland cement, 3 lb. asbestos fiber, and 1 fluid ounce air entraining solution; for other face, scratch coat 3½ cu. ft. and brown coat 4 cu. ft. U.L. listed perlite to 100 lbs. gypsum. Other details as specified in U.L. listing ^c under Walls and Partitions—Design No. 3-4 HR.	4 hrs.*
Wood Partitions, Solid	6 in. partition of 2 by 6 lumber; pieces nailed together flatwise; in vertical position if load bearing. (36)	1 hr. comb.

* Nonbearing.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Wood Stud Exterior Walls Studs 2 x 4 in. or larger.	One side sheathed with ½ in. gypsum sheathing covered with wood drop siding; other side faced with ½ in. 1:2 gypsum and sand plaster on ¾ in. perforated gypsum lath. (39)	1 hr. comb.
	5/32 in. cement-asbestos shingles laid over 14 lb. per 100 sq. ft. asbestos felt over ¾ in. wood sheathing on one side; 4 in. strips of ½ in. gypsum board over edges of studs under facing of 3/16 in. cement asbestos board on other side; filling of mineral wool bats. (9)	1 hr. comb.
Wood Stud Partitions, Plastered Studs 2 x 4 in. or larger. Finished each side as noted	1 in. 1:2½, 1:2½ by volume gypsum-perlite plaster on ¾ in. perforated gypsum lath. Plaster reinforced with 1 in. hexagonal mesh. (105)	bb2 hrs. comb.
	1 in. unsanded, wood fibered gypsum plaster on metal lath. (9)	bb2 hrs.* comb.
	¾ in. 1:2, 1:2 gypsum and sand plaster on metal lath; stud spaces filled with mineral wool. (7, 9)	1½ hrs. comb.
	¾ in. unsanded, wood-fibered gypsum plaster on metal lath. (7, 9)	1½ hrs. comb.
	⅞ in. 1:2, 1:3 gypsum and sand plaster on metal lath; stud spaces filled with mineral wool. (9)	1½ hrs. comb.
	½ in. gypsum-perlite plaster on ¾ in. perforated gypsum lath; plaster mix: 2½ cu. ft. perlite to 100 lbs. fibered gypsum. (49)	1 hr. comb. or 1½ hrs.* comb.
	½ in. gypsum-vermiculite plaster on ¾ in. perforated gypsum lath. Plaster mix, 2½ cu. ft. vermiculite to 100 lbs. fibered gypsum. (50)	1 hr. comb. or 1½ hrs.* comb.
	¾ in. 1:1½, 1:3 gypsum and sand plaster on ¾ in. diamond mesh expanded metal lath of 26 U. S. gauge attached by 1½ in. 4-penny nails 6 in. apart or by equivalent staples. Studs 2 x 2 in. if non-bearing. (10)	1 hr. comb.
	½ in. 1:2, 1:3 gypsum and sand plaster on wood lath; stud spaces filled with mineral wool. (7, 9)	1 hr. comb.
	½ in. 1:2, 1:2 gypsum and sand plaster on ⅞ in. flame-proofed fiberboard plaster base. (7, 9)	1 hr. comb.
	½ in. 1:2 gypsum and sand plaster on ¾ in. perforated gypsum lath, one ¾ in. diam. hole or larger for each 16 sq. in. of lath. (7, 9)	1 hr. comb.
	½ in. unsanded, wood-fibered gypsum plaster on ¾ in. plain gypsum lath. (9)	1 hr. comb.
	⅞ in. plaster, on metal lath attached to studs. Plaster mix for scratch and brown coats, 1:2 fibered gypsum plaster and pumice aggregate containing air entraining agent. (76)	1 hr. comb.
	¾ in. gypsum-vermiculite plaster on metal lath. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. U.L. listed vermiculite plaster aggregate to 100 lbs. fibered gypsum. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 3-1 HR.	1 hr. comb.

* Nonbearing.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Wood Stud Partitions, Plastered Studs 2 x 4 in. or larger. Finished each side as noted	½ in. 1:2, 1:2 gypsum and sand plaster on ¾ in. plain gypsum lath attached by nails fitted with 1½ x 1¾ in. metal lath pads folded over heads, spaced 8 in. vertically, 16 in. horizontally. (7, 9).....	1 hr. comb.
	½ in. 4:1 gypsum and sand plaster on ¾ in. plain gypsum lath; 3 in. strips of metal lath over all joints. (8)	1 hr. comb.
	¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (7, 9)	1 hr. comb.
	¾ in. 1:2, 1:2 gypsum and sand plaster on metal lath. (7, 9)	1 hr. comb.
	¾ in. 1:2 gypsum and sand plaster on U.L. listed wire lath (paper-backed fabric) as specified in U.L. listing ^c , under Walls and Partitions—Design No. 1-1 HR.	1 hr. comb.
	9/16 in. gypsum-perlite plaster on ¾ in. perforated gypsum lath. Plaster mix for scratch and brown coats, 2 to 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 7-1 HR.	1 hr. comb.
	½ in. gypsum-perlite plaster on ¾ in. perforated gypsum lath, securely attached by metal clips. Plaster mix: 2½ cu. ft. perlite to 100 lbs gypsum. (47)	1 hr. comb.
	¾ in. 1:1/10:1/30:2 portland cement, lime, asbestos fiber, sand and 1:3 gypsum and sand plaster on metal lath. (7)	1 hr. comb.
	¾ in. 1:1/30:2, 1:1/30:3 portland cement, asbestos fiber and sand plaster on metal lath. (7, 9)	1 hr. comb.
Wood Stud Partitions Without Plaster Studs 2 x 4 in. or larger. Finished each side as noted	Two layers ⅝ in. gypsum wallboard ^{cc} . First layer attached with 2 in. cement coated nails, spaced 9 in. on centers; second layer attached with 2½ in. cement coated nails spaced 7 in. on centers. Vertical joint between boards on same stud for each layer. Joint to fall on adjacent stud on opposite side. Joints covered with fiber tape and cement. (86)	2 hrs. ^{bb} comb.
	Two layers ⅝ gypsum wallboard ^{cc} . First layer applied vertically with edge joints on the studs and attached with 1⅞ in. cement coated nails spaced 6 in. on centers; second layer applied horizontally with edge joints off the studs and attached with 1⅞ in. cement coated nails spaced 12 in. on centers. All joints and nailheads covered with tape and joint finisher. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 4-2 HR.	2 hrs. ^{bb} comb.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Wood Stud Partitions, Without Plaster Studs 2 x 4 in. or larger. Finished each side as noted	Two layers ½ in. gypsum wallboard. First layer attached with 1½ in. nails having 7/32 in. heads; second layer attached with 1½ in. nails having ¼ in. heads. Outside joints taped and pointed and nail heads covered with joint cement. (38).....	1 hr. comb. or 1½ hrs.* comb.
	Two layers of ½ in. gypsum wallboard applied horizontally with end joints of both layers on studs. First layer attached with 1½ in. nails having 7/32 in. heads; outer layer with 2¾ in. nails having 17/64 in. heads. All joints of finish layer taped, filled, and sanded. (56).....	1½ hrs. comb.
	Two layers of ½ in. gypsum wallboard, the inner layer applied vertically with edge joints off the studs, and attached with 1½ in. nails having 7/32 in. heads; outer layer applied horizontally with end joints on studs, attached with 2¾ in. nails having 17/64 in. heads. All joints of finish layer taped, filled, and sanded. (75).....	1 hr. comb. or 1½ hrs.* comb.
	3/16 in. asbestos-cement sheets over ½ in. gypsum wallboard. (80)	1 hr. comb. or 1½ hrs.* comb.
	Two layers ¾ in. U.L. listed wallboard ^{cc} , glued together and nailed to studs with 1½ in. nails; joints and nailheads covered with tape and joint finisher. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 6-1 HR.	1 hr. comb.
	¾ in. U.L. listed wallboard ^{cc} , nailed to studs with 1½ in. nails; joints and nailheads covered with tape and joint finisher. Other details as specified in U.L. listing ^c , under Walls and Partitions—Design No. 5-1 HR.	1 hr. comb.
	Two layers ¾ in. gypsum wallboard. First layer applied vertically and nailed to studs with 1½ in. cement coated nails on 8 in. centers. Back of second layer cemented and nailed to face of first layer, placed horizontally and nailed with 1¾ in. cement coated nails on 8 in. centers. Joints cemented and taped. (97)	1 hr. comb.
	4 in. strips of ¾ in. gypsum board over edges of studs under facing of 3/16 in. cement-asbestos board; filling of mineral wool bats. (9)	1 hr. comb.
	3/16 in. cement-asbestos boards over ¾ in. gypsum wallboard. (9)	1 hr. comb.
	½ in. gypsum wallboard, stud spaces filled with mineral wool bats nailed in place. (7, 9)	1 hr. comb.

* Nonbearing.

Letter superscripts refer to notes, page 55.

FIRE RESISTANCE RATINGS

WALLS AND PARTITIONS—Continued

Estimated Ratings

Type	Details of Construction	Members Framed in Wall: None or Noncombustible ^c			
		Minimum Equivalent Thickness ^a Inches, for Ratings of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.
Concrete Masonry Units	Coarse aggregate, expanded slag, or pumice. (43)	4.7	4.0	3.2	2.1
	Coarse aggregate, expanded clay or shale. (43)	5.7	4.8	3.8	2.6
	Coarse aggregate, limestone, cinders or unexpanded slag. (43).....	5.9	5.0	4.0	2.7
	Coarse aggregate, calcareous gravel. (43)	6.2	5.3	4.2	2.8
	Coarse aggregate, siliceous gravel. (43)	6.7	5.7	4.5	3.0
Type	Details of Construction	Minimum Thickness ^b , Inches for Ratings of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.
Plain Concrete	Solid walls. (11, 33).....	7½	6½	5½	4*
Reinforced Concrete	Solid walls, unplastered:				
	Group 1 Aggregates ^k , ¾ in. maximum size. (11)	6½	6	5	3½
	Group 2 Aggregates ^k , ¾ in. maximum size. (11, 33).....	7½	6½	5½	4*
	Solid walls plastered each side with ¾ in. portland cement stucco or portland cement or gypsum plaster:				
	Group 1 Aggregates ^k , ¾ in. maximum size. (11)	5	4	3*	3*
	Group 2 Aggregates ^k , ¾ in. maximum size. (11)	6	5	4	3*
Stone Masonry	Solid walls	12	12	12	8

* Nonbearing.

See note ^e for definition of equivalent thickness.

Letter superscripts refer to notes, page 55.

NOTES

^a The ratings for walls with combustible members framed into the wall, apply for members framed in not over 4 inches

^b Thicknesses given do not include the thickness of plaster where plaster is specified.

^c See "Building Materials List" published annually by Underwriters' Laboratories, Inc. The use of materials listed by Underwriters' Laboratories, Inc., provides reasonable assurance that the materials conform to the standard for such materials established by the Laboratories in connection with the listing.

^d A 10-in. wall may be used for this rating if hollow spaces near combustible members are filled with fire resistive material for the full thickness of the wall and for 4 inches or more above, below and between the combustible members.

^e Equivalent thickness is the average thickness of the solid material in the wall. It may be found by taking the total volume of a wall unit, subtracting the volume of core spaces, dividing this by the area of the face of the unit. Where walls are plastered or faced with brick the thickness of plaster or brick may be included in determining the equivalent thickness.

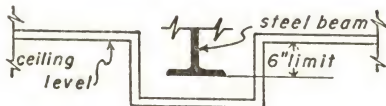
^f Where combustible members are framed into the wall, the wall must be of such thickness or be so constructed that the thickness of solid material between the end of each member and the opposite face of the wall, or between members set in from opposite sides, will be not less than 93% of the thickness shown in the table.

^g The ratings of load bearing hollow clay tile depend in certain cases on the number of cells and units in the wall thickness. These are shown in the table along with the total thickness (in inches) of the wall, "2U" representing for example, two units and "4C" representing four cells in the wall thickness.

^h An 8-inch tile wall may be used for this rating if hollow spaces are filled as in Note ^d.

ⁱ With combustible structural members framed into the wall, plaster is effective in increasing the fire resistance (over that for a similar wall or partition unplastered) only when applied on the side opposite that on which the structural members are framed in, and only with respect to fire exposure from the plastered side.

^j Ratings given are applicable where there is no combustible material or construction in the enclosed ceiling space. Ceiling to be at such a level that the beams, girders or trusses to be considered as protected by the ceiling, will not extend below the level of the ceiling more than 6 in. (as illustrated below), unless otherwise specified. This depth at any point, to be considered as the average depth on the two sides. Ratings are for protection only from fire beneath the ceiling.



^k Group 1 and group 2 aggregates are defined in the "Standard Specifications for Concrete and Reinforced Concrete" of the 1940 "Joint Committee Report" as follows:

"Group 1. Blast-furnace slag, limestone, calcareous gravel, trap rock, burnt clay or shale, cinders containing not more than 25% of combustible material and not more than 5% of volatile material, and other materials meeting the requirements of these specifications and containing not more than 30% quartz, chert, flint, and similar materials.

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"Group 2: Granite, quartzite, siliceous gravel, sandstone, gneiss, cinders containing more than 25%, but not more than 40% of combustible material and not more than 5% of volatile material and other materials meeting the requirements of these specifications, and containing more than 30% of quartz, chert, flint, and similar materials."

^l Thicknesses given are of the protection around the outside of the steel column, beam, girder or truss, or cast iron column, and outside of the reinforcing steel in reinforced concrete columns, beams, girders and trusses. They do not include thickness of plaster except where the protection consists only of metal lath and plaster.

^m The fire resistance of columns varies with the area of solid material in the cross section of the column—the larger the column the greater the fire resistance, for a given thickness of protection around the structural or reinforcing steel. The column dimensions given are the outer cross sectional dimensions of the steel or cast iron columns and the outside cross sectional dimensions of reinforced concrete columns. Columns smaller than those listed may require greater thicknesses of protection for the same degree of fire resistance. For columns which are not square the protection should correspond to that for the square column having the same or next smaller cross sectional area.

ⁿ Calcareous aggregate containing a combined total of not more than 10% quartz, chert and flint for the coarse aggregate.

^o Cinders contained not over 10% unburned coal and not over 5% ash.

^p Wire ties consisted of No. 5 B. & S. gauge (0.18 in. diam.) steel wire wound spirally around the steel column on a pitch of 8 in.

^q Outside wire ties consisted of No. 12 B. & S. gauge (0.08 in. diam.) steel wire tied around the outside of each course of tile at the middle.

^r Tested with covering of $\frac{3}{4}$ in. gypsum and sand plaster, on which the rating was 7 hours.

^s The aggregates used contained 60% or more of quartz, chert, or granite.

^t Tested with covering of $\frac{1}{2}$ in. gypsum and sand plaster, on which the rating was 6 hours.

^u The "Standard Methods of Fire Tests of Building Construction and Materials" fix a temperature limit for wood members such as sleepers set into the top slab of a floor construction. Except where test data are available to show that wood members may be embedded in the top slab a certain depth without developing temperatures higher than the standard specifies, or except as otherwise specifically indicated, the rating of floor and ceiling constructions are based on the assumption that no wood sleepers or other combustible members will be embedded in the specified top covering of concrete or gypsum. Such members may rest on top of the specified thickness of concrete or gypsum with additional concrete or gypsum fill between sleepers.

^v The thickness of concrete floor slab given is the minimum thickness over the joists. Between joists the thickness will be greater due to sagging of the metal lath. Tests at the National Bureau of Standards have indicated that this additional thickness between joists is necessary if the specified fire resistance is to be assured. If the normal sag between joists is not present the average thickness of slab should be $\frac{1}{4}$ in. greater. Concrete plank may be used for the top slab if joints are thoroughly grouted and the plank is at least $\frac{1}{4}$ in. thicker than the specified thickness for the top slab.

^w Metal lath of approved weight serving as form for poured top slab may be considered as reinforcement.

^x Siliceous gravel contained 100% clear quartz.

^y These ratings apply to columns with standard ties or spirals, and to columns without spirals if designed on the basis that the protective concrete covering carries no load. If the design load is based on the gross column area and the column does not have adequate ties or spirals the actual fire resistance will be considerably lower.

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^z Ratings given are for fire exposure from the plastered side. Somewhat higher ratings were obtained with brick face exposed to fire.

^{aa} Wire ties of No. 8 SWG (0.16 in. diam.) steel wire wound spirally around steel column on a pitch of 8 in.

^{bb} This construction is not acceptable for use where a 2-hour construction is required to be of noncombustible materials, as is specified for all two-hour partitions in the National Building Code.

^{cc} Wallboard or coreboard with a specially formulated core which provides greater fire resistance than regular wallboard or coreboard of the same thickness. If the wallboard or coreboard in the description is "U.L. listed", wallboard or coreboard having an attached Underwriters' Laboratories, Inc. label stating the same type of construction and design number as that given in the description must be used.

^{dd} Portions of this concrete slab not containing electrical raceways and junction boxes may consist of a 3 in. concrete slab.

^{ee} Portions of this concrete slab not containing electrical raceways and junction boxes may consist of a 2 in. concrete slab.

^{ff} Rating given applies only when the floor has a minimum bearing of 3 inches at edges and is restrained at all edges. The concrete topping is not considered as a structural element of the assembly.

^{gg} Where metal ceiling, floor and wall runner strips are used in place of wood runner strips, the construction is considered as noncombustible.

^{hh} The minimum equivalent thickness and the approximate face shell thickness of units are based on units having a cement-aggregate proportion of not more than 1:9.

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